COMPETENCY STANDARDS & ASSESSMENT GUIDE
FOR
MILLING MACHINE OPERATION

Skills for Employment Investment Program (SEIP)
Finance Division, Ministry of Finance

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INTRODUCTION:

The Skills for Employment Investment Program (SEIP) Project of the Finance Division of the Ministry of Finance has embarked on a project which aims to qualitatively and quantitatively expand the skilling capacity of identified public and private training providers by establishing and operationalizing a responsive skill eco system and delivery mechanism through a combination of well-defined set of funding triggers and targeted capacity support.

Among the many components of the project, one is to promote a Market Responsive Inclusive Skills Training Delivery program. Key priority economic growth sectors identified by government have been targeted by the project to improve current job skills along with up-skilling of the existing workforce to ensure 'required skills to industry standards'. Training providers are encouraged and supported to work with the industry to address identified skills to enable industry growth and increased employment through the provision of market responsive inclusive skills training programs. Priority sectors were identified to adopt a demand driven approach to training with effective inputs from Industry Skills Councils (ISCs), Employer Associations and Employers.

This document is developed to improve skills in accordance with the job roles and skill sets of the occupation and ensure that the required skills are aligned to industry requirements.

The document details the format, sequencing, wording and layout of the Competency Standard for an occupation which comprised Units of Competence and its corresponding Elements.

OVERVIEW:

A **Competency Standard** is a written specification of the knowledge, skills and attitudes required for the performance of a job or occupation or trade corresponding to the standard of performance required in the workplace.

Competency standard:

- provides a consistent and reliable set of components for training, recognizing and assessing people's skills, and may also have optional support materials.
- enables industry recognized qualifications to be awarded through direct assessment of workplace competencies
- encourages the development and delivery of flexible training which suits individual and industry requirements
- encourages learning and assessment in a work-related environment which leads to verifiable workplace outcomes.

Competency Standards are developed by a working group who comprised national and international process experts and the participation of experts from the industry to identify the competencies required of an occupation in particular sector.

Competency Standards describe the skills, knowledge and attitude needed to perform effectively in the workplace. Competency Standards acknowledge that people can achieve vocational and technical competency in many ways by emphasizing what the learner can do, not how or where they learned to do it.

With Competency Standards, training and assessment may be conducted at the workplace rat training organization or any combination of these.

A Unit of Competency describes a distinct work activity that would normally be undertaken by one person in accordance with industry standards.

Units of Competency are documented in a standard format that comprises:

- Reference to Industry Sector, Occupational Title and Occupational Description
- Unit code
- Unit title
- Unit descriptor
- Unit of Competency
- Elements and performance criteria
- Variables and range statement
- Evidence guides

Together all the parts of a Unit of Competency:

- Describe a work activity
- Guide the assessor in determining whether the candidate is competent.

Identification and validation of units of competency and elements for each occupation were made by expert workers of various construction companies through an industry consultative workshop held at the Bangladesh Engineering Industry Owners Association (BEIOA) on 28th of February 2016.

Profile of experts and facilitators who participated in the Competency Verification and Validation Workshop are given below:

EXPERTS INVOLVED:

Competency Verification-Validation Experts:

Name	Company	Job Position/Expertise
Al-Hajj AbulHasim	Nipun Engineering	Lathe machine operation expert
Sayed Hayder Ali	Asian Tools	Lathe machine operation expert
Md. Ali Akbar	Akbar Engineering Works	Milling machine operation expert
Khandaker Nasir Uddin	Gear Center Engineering	Milling machine operation expert
Md. Nazrul Islam	NH Welding Works	Welding expert
Md. Kamal Miah	Kamal Welding Works	Welding expert
Md. Riaz	Riaz Refrigeration Works	Refrigeration and Air Conditioning expert
Md. Abdul Awoal	Joyti Refrigeration Works	Refrigeration and Air Conditioning expert
Engr. Md. Faruk Hossain	Farmamekh Engineering	CAD-CAM expert
A.K. Azad	Azad Industry	CAD-CAM expert
Salim Ahmed	Salim Engineering Works	Master Craftsman expert

AnowarulHaqueAnswari	Anowar Engineering Works	Master Craftsman expert

Workshop Facilitators:

Md. Mohiuzzaman	SEIP	Course Specialist
EmeterioCedillo, Jr.	SEIP	International Specialist
Md. Atiar Rahman	SEIP	National Specialist

The ensuing sections of this document comprise a description of the respective occupation with all the key components of a Unit of Competency:

- A chart with an overview of all Units of Competency for the respective occupation including the Unit Codes and the Unit of Competency titles and corresponding Elements.

- The Competency Standards that include the Unit of Competency, Unit Descriptor, Elements and Performance Criteria, Range of Variables, Curricular Content Guide and Assessment Evidence Guide.

COMPETENCY PROFILE/ CHART

for **Milling Machine Operation**

UNITS OF COMPETENCY	ELEMENTS			
Generic (Basic) Competencies				
Perform Computations Using Basic Mathematical Concepts (SEIP-LIG-MIL-1-G)	Identify calculation requirements in the workplace.	Select appropriate mathematical methods/concepts for the calculation	Use tool/instrument to perform calculations	
Apply Occupational Health and Safety (OH&S) Practices in the Workplace (SEIP-LIG-MIL-2-G)	Identify OHS policies and procedures	Apply personal health and safety practices	Report hazards and risks	Respond to emergencies
Communicate In English in the Workplace (SEIP-LIG-MIL-3-G)	Read and understand workplace documents in English	Write simple workplace written communications in English.	Listen and comprehend to English conversation	Perform conversations in English language
Operate In a Self-Directed Team (SEIP-LIG-MIL-4-G)	Identify team goals and processes.	Communicate and cooperate with team members.	Work as a team member	Solve problems as a team member
Sector Specific (Common) Competencies				
Interpret Technical Drawings and Manuals SEIP-LIG-MIL-1-S)	Select technical drawing.	Interpret technical drawings.	Interpret operation and maintenance manuals	
Work With Mechanical Hand and Power Tools (SEIP-LIG-MIL-2-S)	Inspect hand tools and power tools for usability	Use hand tools properly and safely	Operate power tools properly and safely	Clean/maintain hand tools and power tools after use
Carry Out Precision Checks and Measurements (SEIP-LIG-MIL-3-S)	Select the job to be checked and measured	Select measuring and checking tool/instrument	Obtain measurements and checks	Record/communicate measurement and check results
	Clean, maintain and store measuring instruments.			

Apply Quality Systems And Procedures **(SEIP-LIG-MIL-2-S)**	Work within quality system	Apply and monitor quality system improvements in the workplace	Hold responsible for work quality	Apply standard procedures for each job.

Occupation Specific (Course) Competencies

Perform Bench Working Operations (SEIP-LIG-MIL-1-O)	Gather tools, equipment and materials for bench work	Perform bench work	Carry out drilling and reaming operations	Carry out manual thread cutting and tap removal
	Perform off-hand grinding operation	Perform basic welding operation	Perform heat treatment processes	Clean and store tools and equipment
Carry Out Grinding Of Cutting Tools (SEIP-LIG-MIL-2-O)	Determine job requirement	Select grinding wheels and accessories	Perform tool grinding of milling cutters	Perform drill bit grinding
	Clean/maintain the workplace			
Perform Milling Machine Operation **(SEIP-LIG-MIL-3-O)**	Identify different types of milling machine	Identify different parts of the milling machine	Determine operating parameters of milling machine	Identify and set the milling accessories and attachment
	Identify and set different milling cutter	Determine methods of milling operation	Clean and maintain milling machine components, tools and accessories	
Perform Indexing Operation Using Indexing Head **(SEIP-LIG-MIL-4-O)**	Identify different parts of index head	Set index head on milling machine	Identify different types of indexing methods	Perform different indexing methods
	Clean and store tools and equipment			

Perform Plain, Side and Face Milling Operation **(SEIP-LIG-MIL-5-O)**	Determine job requirement	Perform Plain milling	Perform side milling	Perform face milling
	Perform gang and straddle milling	Clean and store the tools and equipment		
Perform Slot, Part Off, End and Angular Milling Operation **(SEIP-CON-MAS-6-O)**	Determine job requirement	Perform slot-milling operation	Perform parting off milling operation	Perform end-milling operation
	Performing angular milling operation	Clean and store tools and equipment		
Perform Gear Cutting Operation On Milling Machines **(SEIP-LIG-MIL-7-O)**	Determine job requirement	Perform gear cutting	Clean and store the tools and equipment	

Units & Elements at Glance:

Generic (Basic) Competencies (30 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-LIG-MIL-1-G	Perform Computations Using Basic Mathematical Concepts	1.Identify calculation requirements in the workplace 2.Select appropriate mathematical methods/concepts for the calculation. 3.Use tool/instrument to perform calculations	10
SEIP-LIG-MIL-2-G	Apply Occupational Health and Safety (OH&S) Practices in the Workplace	1. Identify OHS policies and procedures 2. Apply personal health and safety practices 3. Report hazards and risks 4. Respond to emergencies	10
SEIP-LIG-MIL-3-G	Communicate in English in the Workplace	1. Read and understand workplace documents in English 2. Write simple workplace communications in English 3. Listen and comprehend to English conversations 4. Perform conversations in English language	5
SEIP-LIG-MIL-4-G	Operate in a Self-Directed Team	1. Identify team goals and work processes 2. Communicate and cooperate with team members. 3. Work as a team member. 4. Solve problems as a team member	5
Total Hour			**30**

Sector Specific (Common) Competencies (30 hrs.)

Code	Unit of Competency	Elements of Competency	Duration (Hours)
SEIP-LIG-MIL-1-S	Interpret Technical Drawings and Manuals	1. Select technical drawing 2. Interpret technical drawings. 3. Interpret operation & maintenance manuals	10
SEIP-LIG-MIL-2-S	Work with Mechanical Hand and Power Tools	1. Inspect hand tools and power tools for usability 2. Use hand tools properly and safely 3. Operate power tools properly and safely 4. Clean/ maintain hand tools and power tools after use	10
SEIP-LIG-MIL-3-S	Carry Out Precision Checks and Measurements	1. Select the job to be checked and measured 2. Select measuring and checking tool/instrument 3. Obtain measurements and checks 4. Record/communicate measurement and check results 5. Clean, maintain and store measuring instruments.	5
SEIP-LIG-MIL-4-S	Apply Quality Systems and Procedures	1. Work within quality system 2. Apply and monitor quality system improvement in the workplace 3. Hold responsible for work quality 4. Apply standard procedures for each job.	5
Total Hours			**30**

Occupation Specific (Core) Competencies (300 hrs.)

Code	Unit of Competency	Elements of Competency	Guided Learning Hours
SEIP-LIG-MIL-1-O	Perform Bench Working Operations	1. Gather tools, equipment and materials for bench work 2. Perform bench work 3. Carry out drilling and reaming operations 4. Carry out manual thread cutting and tap removal 5. Perform off-hand grinding operation 6. Perform basic welding operation 7. Perform heat treatment processes 8. Clean and store tools and equipment	50
SEIP-LIG-MIL-2-O	Carry Out Grinding of Cutting Tools	1. Determine job requirement 2. Select grinding wheels and accessories 3. Perform tool grinding of Milling cutters 4. Perform drill bit grinding 5. Clean/maintain the workplace	20
SEIP-LIG-MIL-3-O	Perform Milling Machine Operation	1. Identify different types of milling machine 2. Identify different parts of the milling machine 3. Determine operating parameters of milling machine 4. Identify and set the milling accessories and attachment 5. Identify and set different milling cutter 6. Determine methods of milling operation 7. Clean and maintain milling machine components, tools and accessories	30
SEIP-LIG-MIL-4-O	Perform Indexing Operation Using Indexing Head	1. Identify different parts of index head 2. Set index head on milling machine 3. Identify different types of indexing methods 4. Perform different indexing methods 5. Clean and store tools and equipment	30

SEIP-LIG-MIL-5-O	Perform Plain, Side and Face Milling Operation	1. Determine job requirement 2. Perform Plain milling 3. Perform side milling 4. Perform face milling 5. Perform gang and straddle milling 6. Clean and store the tools and equipment	60
SEIP-LIG-MIL-6-O	Perform Slot, Part Off, End and Angular Milling Operation	1. Determine job requirement 2. Perform slot milling operation 3. Perform parting off milling operation 4. Perform end milling operation 5. Performing angular milling operation 6. Clean and store tools and equipment	60
SEIP-LIG-MIL-7-O	Perform Gear Cutting Operation On Milling Machines	1. Determine job requirement 2. Perform gear cutting 3. Clean and store the tools and equipment	50
Total Hours			**300**

COMPETENCY STANDARD: MILLING MACHINE OPERATION

A: The Generic (Basic Competencies)

Unit of Competency: **PERFORM COMPUTATIONS USING BASIC MATHEMATICAL CONCEPTS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-MIL-1-G
Unit Descriptor: This unit of competency requires the knowledge, skills and attitude to perform computations using basic mathematical concepts in the workplace. It specifically includes the tasks of identifying calculation requirements in the workplace, selecting appropriate mathematical method/concept for the calculation and using appropriate instruments tools to carry out calculation.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify calculation requirements in the workplace	1.1 **Calculation requirements** are identified from **workplace information.**
2. Select appropriate mathematical methods/concepts for the calculation.	2.1 **Appropriate method** is selected to carry out the calculation requirements.
3. Use tool/instrument to perform calculations	3.1 Calculations are completed using appropriate **tools and instruments.**

Range of variables:

Variable	Range (May include but not limited to)
1. Calculation requirements.	1.1 Area 1.2 Height 1.3 Length/Breadth/thickness 1.4 Diameter 1.5 Weight 1.6 Capacity 1.7 Time 1.8 Temperature. 1.9 Material usage 1.10 Speed 1.11 Costing 1.12 Mass 1.13 Density
2. Workplace information	2.1 Mechanical Plan 2.2 Design 2.3 Working drawing 2.4 Verbal instructions 2.5 Job order
3. Appropriate method	3.1 Addition 3.2 Subtraction 3.3 Division 3.4 Multiplication 3.5 Conversion 3.6 Percentage and ratio calculation

	3.7 Simple equation
4. Tools/instruments	4.1 Calculator 4.2 Computer

Curricular Content Guide

1. Underpinning Knowledge	1.1 Numerical concept 1.2 Basic mathematical methods such as addition, subtraction, multiplication, division, and percentage. 1.3 Mathematical language, symbols and terminology. 1.4 Measuring units 1.5 Knowledge of computer application
2. Underpinning Skills	2.1 Adding numbers 2.2 Subtracting numbers 2.3 Multiplying numbers 2.4 Dividing numbers 2.5 Measuring of linear 2.6 Using of mathematical language, symbols, terminology and technology 2.7 Measuring of different physical parameter 2.8 Calculating geometrical parameters: angle, parallelism, perpendicularity, area and volume
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Promptness in carrying out activities 3.3 Tidiness and timeliness 3.4 Respect to peers, sub-ordinates and seniors in workplace 3.5 Environmental concern 3.6 Sincerity and honesty
4. Resource Implications	The following resources must be provided 4.1 Stationeries 4.2 Consumables 4.3 Calculators 4.4 Computers 4.5 Measuring tape

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified calculation requirements from workplace information 1.2 Selected appropriate method to carry out the calculation requirements 1.3 Completed calculations using appropriate tools/instruments
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Oral questioning 2.3 Demonstration
5. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **APPLY OCCUPATIONAL HEALTH AND SAFETY (OHS) PRACTICES IN THE WORKPLACE**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-MIL-2-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply occupational health and safety (OH&S) practices in the workplace. It specifically includes the tasks of identifying OHS policies and procedures, applying personal health and safety practices, reporting hazards and risks and responding to emergencies.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify OHS policies and procedures	1.1 **OHS policies** and safe operating procedures are read and understood. 1.2 Safety signs and symbols are identified and followed. 1.3 Emergency response, evacuation procedures and other contingency measures are determined.
2. Apply personal health and safety practices	2.1 OHS policies and procedures are followed and practiced. 2.2 **Personal Protective Equipment (PPE)** is selected and used. 2.3 Personal hygiene is maintained.
3. Report hazards and risks	3.1 **Hazards and risks** are identified, assessed and controlled. 3.2 Incidents arising from hazards and risks are reported to authority. 3.3 Corrective actions are implemented to correct unsafe conditions in the workplace.
4. Respond to emergencies	4.1 Alarms and warning devices are responded. 4.2 **Emergency response plans and procedures** are implemented. 4.3 **First aid procedure** is applied during emergency situations.

Range of Variables

Variable	Range May include but not limited to:
1. OHS policies	1.1 International OHS requirements 1.2 Bangladesh standards for OHS 1.3 Building Code 1.4 Fire Safety Rules and Regulations 1.5 Light Engineering Industry Guidelines
2. Personal Protective Equipment (PPE)	2.1 Apron 2.2 Gas Mask 2.3 Gloves 2.4 Safety shoes 2.5 Helmet 2.6 Face mask 2.7 Overalls 2.8 Goggles and safety glasses 2.9 Ear plugs 2.10 Sun block 2.11 Chemical/Gas masks
3. Hazards and risks	3.1 Chemical hazards. 3.2 Biological hazards. 3.3 Physical Hazards.

	3.3.1 Machine hazards. 3.3.2 Materials hazards. 3.3.3 Tools and Equipment hazards.
4. Emergency response plans and procedures	4.1 Firefighting procedures 4.2 Earthquake response procedures 4.3 Evacuation procedures 4.4 Medical and first aid
5. First aid procedure	5.1 Washing of open wound 5.2 Washing chemically infected area 5.3 Applying bandage 5.4 Tourniquet 5.5 Applying CPR (Cardiopulmonary Resuscitation) 5.6 Taking appropriate medicine

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 OHS workplace policies and procedures. 1.2 Work safety procedures. 1.3 Emergency procedures. 1.3.1 Firefighting. 1.3.2 Earthquake response. 1.3.3 Explosion response. 1.3.4 Accident response. 1.4 Types of hazards (biological, chemical and physical) and their effects. 1.5 PPE types and uses. 1.6 Personal hygiene practices. 1.7 OHS awareness.
2. Underpinning Skills	2.1 Identifying OHS policies and procedures 2.2 Following personal work safety practices 2.3 Reporting hazards and risks 2.4 Responding to emergency procedures 2.5 Maintaining physical well-being in the workplace 2.6 Performing first aid. 2.7 Performing basic firefighting accessories using fire extinguishers 2.8 Applying basic first aid procedures
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 PPEs 4.3 Firefighting equipment 4.4 Emergency response manual 4.5 First aid kits

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Followed OHS policies and procedures

	1.2 Selected and used personal protective equipment (PPE) 1.3 Reported incidents arising from hazards and risks to authority 1.4 Emergency response plans and procedures are implemented 1.5 Applied basic first aid procedure
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Demonstration 2.3 Oral questioning
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **COMMUNICATE IN ENGLISH IN THE WORKPLACE**	**Nominal Duration:** 5 hrs.	**Unit Code:** SEIP-LIG-MIL-3-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply English communication in the workplace. It specifically includes work tasks of reading and understanding workplace documents in English, writing simple workplace written communications in English, listening and comprehending to English conversations and performing conversations in English.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Read and understand workplace documents in English	1.1 Workplace documents are read and understood. 1.2 Visual information is interpreted.
2. Write simple workplace communications in English	2.1 Simple **routine workplace documents** are prepared using key words, phrases, simple sentences and **visual aids** are prepared 2.2 Key information is written in the appropriate places in standard forms.
3. Listen and comprehend to English conversations	3.1 Active listening is demonstrated.
4. Perform conversations in English language	4.1 Conversation is performed in English with peers, customers and management to the required workplace standard.

Range of Variables

Variable	Range May Include but not limited to:
1. Routine workplace documents	1.1 Agenda 1.2 Simple reports such as progress and incident reports 1.3 Job sheets 1.4 Operational manuals 1.5 Brochures and promotional material 1.6 Visual and graphic materials 1.7 Standards 1.8 OSH information 1.9 Signs
2. Visual aids	2.1 Maps 2.2 Diagrams 2.3 Forms 2.4 Labels 2.5 Graphs 2.6 Charts

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Read workplace documents in English 1.2 Write simple routine workplace documents in English 1.3 Listen to conversation in English. 1.4 Perform conversation in English.

	1.5 Interaction skills (i.e., teamwork, interpersonal skills, etc.). 1.6 Job roles, responsibilities and compliances.
2. Underpinning Skills	2.1 Ability to read and understand workplace documents in English by using appropriate vocabulary and grammar, standard spelling and punctuation 2.2 Ability to write simple routine workplace documents in English such as Schedules and agenda, job sheets, operational manuals and brochures and promotional material. 2.3 Ability of listening in English and interpreting 2.4 Ability to perform conversation in English with peers, customers and management to the required workplace standard. 2.5 Work effectively with others. 2.5.1 Listening and questioning skills 2.5.2 Ability to follow simple directions
3. Underpinning Attitudes	3.1 Commitment to occupational safety and health 3.2 Promptness in carrying out activities. 3.3 Tidiness and timeliness. 3.4 Respect of peers, sub-ordinates and seniors in workplace. 3.5 Environmental concern. 3.6 Sincere and honest to duties.
4. Resource Implications	The following resources must be provided: 4.1 Work place Procedure 4.2 Materials relevant to the proposed activity 4.3 All tools, equipment, material and documentation required. 4.4 Relevant specifications or work instructions

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Converse in English with peers and customers 1.2 Made reports of workplace documents in English
2. Methods of Assessment	Methods of assessment may include but not limited to: 2.1 Written test 2.2 Demonstration 2.3 Oral questioning
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **OPERATE IN A SELF-DIRECTED TEAM**	**Nominal Duration:** 5 hrs.	**Unit Code:** SEIP-LIG-MIL-4-G
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to work as a team member. It specifically includes work tasks of identifying team goals and work processes, communicating and cooperating with team members, working and solving problems as a team member.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify team goals and work processes	1.1 Team goals and collaborative decision making processes are identified. 1.2 Roles and responsibilities of team members are identified 1.3 Relationships within team and with other workers are identified
2. Communicate and cooperate with team members.	2.1 Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives 2.2 Formal and informal **forms of communication** are used effectively to support team achievement. 2.3 Diversity is respected and valued in team functioning. 2.4 Views and opinions of other team members are understood and valued. 2.5 Workplace terminology is used correctly to assist communication
3. Work as a team member.	3.1 Duties, responsibilities, authorities, objectives and task requirements are identified and clarified with team 3.2 Tasks are performed in accordance with organizational and team requirements, specifications and workplace procedures. 3.3 Team member's support with other members are made to ensure team achieves goals, awareness and requirements. 3.4 Agreed reporting lines are followed using standard operating procedure.
4. Solve problems as a team member	4.1 Current and potential problems faced by team are identified 4.2 A solution to the problem is identified 4.3 Problems are solved effectively and the outcome of the implemented solution is evaluated

Range of Variables

Variable	Range May Include but not limited to:
1. Forms of communication	1.1 Agenda 1.2 Simple reports such as progress and incident reports. 1.3 Job sheets. 1.4 Operational manuals. 1.5 Brochures and promotional material. 1.6 Visual and graphic materials. 1.7 Standards. 1.8 OSH information. 1.9 Signs.

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Team goals and collaborative decision making processes 1.2 Roles and responsibilities of team members 1.3 Relationships within team and with other workers 1.4 Effective interpersonal skills to interact with team members 1.5 Effective formal and informal forms of communication 1.6 Value of diversity in team functioning. 1.7 Correct use of workplace terminology 1.8 Team's duties, responsibilities, authorities, objectives and task requirements 1.9 Support mechanism to other members of team to ensure achievements of goals. 1.10 Methods of identifying current and potential problems faced by a team 1.11 Effectively problems solving methods and evaluation of outcomes
2. Underpinning Skills	2.1 Identifying team goals and collaborative decision making processes 2.2 Identifying roles and responsibilities of team members 2.3 Identifying relationships within team and with other workers 2.4 Using effective interpersonal skills to interact with team members and to contribute to activities and objectives 2.5 Using formal and informal forms of communication 2.6 Understanding and valuing views and opinions of other team members 2.7 Performing tasks in accordance with organizational and team requirements, specifications and workplace procedures. 2.8 Supporting other members of the team to ensure team achieves goals, awareness and requirements. 2.9 Identifying current and potential problems faced by the team 2.10 Identifying solutions to the problem 2.11 Solving problems effectively and evaluating the outcome of the implemented solution
3. Underpinning Attitudes	3.1 Teamwork 3.2 Promptness in carrying out activities 3.3 Tidiness and timeliness 3.4 Respect of peers, sub-ordinates and seniors in workplace 3.5 Sincere and honest to duties
4. Resource Implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Pens 4.3 Papers 4.4 Work books 4.5 Learning manuals

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified team goals and work processes 1.2 Communicated and cooperated with team members. 1.3 Worked as a team member 1.4 Solved problems as a team member
2. Methods of Assessment	Methods of assessment may include but not limited to:

	2.1 Written test 2.2 Demonstration 2.3 Oral questioning
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

B. The Sector Specific (Common) Competencies

Unit of Competency: **INTERPRET TECHNICAL DRAWINGS AND PLANS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-MIL-1-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required of a worker to translate technical drawings and plans. It specifically includes the tasks of selecting technical drawing, interpreting technical drawings and storing manuals, designs and plans.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Select technical drawing	1.1 **Drawing** is selected and checked to ensure that it conforms to the job requirements. 1.2 Drawing is validated.
2. Interpret technical drawings.	2.1 Drawing components, assemblies are identified 2.2 Dimensions are identified according to job requirement 2.3 Clearances/tolerances are checked in accordance with workplace standard 2.4 **Instructions** are identified and followed accurately. 2.5 Material **specifications** are interpreted 2.6 Symbols in drawing are interpreted.
3. Interpret operation & maintenance manuals	3.1 Operation and maintenance manuals are collected and interpreted 3.2 Operation and maintenance manuals are followed when operating and maintaining lathe machine

Range of Variables

Variable	*Range* May Include but not limited to:
1. Drawing	1.1 Technical drawing 1.2 Sketches 1.3 Manuals
2. Instructions	2.1 Note 2.2 Instruction 2.3 Special instruction 2.4 Precaution
3. Specifications	3.1 Product specifications 3.2 Method specifications 3.3 Material specifications

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Technical drawing interpretation 1.2 Sequence of drawing 1.3 Methods of checking and applying drawing for work 1.4 Drawing selection and checking method to ensure conformity to the job requirements. 1.5 Drawing components, assemblies 1.6 Identification of dimensions according to job requirement

	1.7 Procedure of checking clearances/tolerances 1.8 Work instructions 1.9 Material specifications 1.10 Drawing symbols interpretation 1.11 Use of operation and maintenance manuals
2. Underpinning Skills	2.1 Practicing workplace safety 2.2 Interpreting drawing, following operation and maintenance manuals, 2.3 Performing jobs in accordance with the drawing 2.4 Performing calculation as per drawing 2.5 Selecting and checking of drawing to ensure conformity to the job requirements. 2.6 Identifying drawing components and assemblies 2.7 Identifying dimensions according to job requirement 2.8 Checking clearances/tolerances in accordance with workplace standard 2.9 Following operation and maintenance manuals when operating and maintaining lathe machine
3. Underpinning Attitudes	3.1 Care in the use of drawings/manuals 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Sincere and honest to duties.
4. Resource Implications	The following resources must be provided: 4.1 Workplace (simulated or actual) 4.2 Relevant drawing/manuals 4.3 Pens 4.4 Papers 4.5 Work books 4.6 Learning manuals

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified dimension according to job requirement 1.2 Maintained clearances and tolerances according to workplace requirement. 1.3 Interpreted drawing symbols 1.4 Interpreted operation & maintenance manuals
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **WORK WITH MECHANICAL HAND AND POWER TOOLS**	**Nominal Duration:** 10 hrs.	**Unit Code:** SEIP-LIG-MIL-2-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to work with mechanical hand and power tools. It specifically includes the tasks of inspecting hand tools and power tools for usability, using hand tools properly and safely, operating power tools properly and safely and cleaning/maintaining hand tools and power tools after use.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Inspect hand tools and power tools for usability	1.1 Appropriate tools are selected 1.2 Application of tools to job requirement is determined 1.3 Usability of tools are checked and verified 1.4 **Hand tools** and **power tools** are prepared. 1.5 Sources of power supply for power tools are identified
2. Use hand tools properly and safely	2.1 Appropriate hand tool for the job is used 2.2 Proper and safe use/operation is applied in the different types of hand tools 2.3 **Safety precautions** is observed when using hand tools 2.4 Unsafe or faulty tools are identified and marked for repair
3. Operate power tools properly and safely	3.1 Power supply outlet and electrical cord are inspected and confirmed safe for use in accordance with established workplace safety requirements. 3.2 Proper sequence of operation is applied in using power tools to produce results. 3.3 Power tools are used safely in accordance to manufacturer's operating specification.
4. Clean/maintain hand tools and power tools after use	4.1 Dust and foreign matters are removed from power tools in accordance to workplace standard. 4.2 Condition of tools is checked after use 4.3 Appropriate lubricant is applied after use and prior to storage 4.4 **Measuring tools** are checked and calibrated. 4.5 Defective tools, instruments, power tools and accessories are inspected and corrected or replaced

Range of Variables

Variable	Range May include but not limited to:	
1. Hand tools	1.1 Ball peen hammer. 1.2 Cross peen hammer. 1.3 Straight peen hammer. 1.4 Mallet/soft, hammer. 1.5 Bench vise. 1.6 Soft jaw. 1.7 Rough file. 1.8 Medium file. 1.9 Smooth file. 1.10 Punches. 1.11 Chisels. 1.12 Wrenches.	1.29 Drill bits 1.30 Tap extruder. 1.31 Screw Extruder. 1.32 Hacksaw frame. 1.33 Hacksaw blade. 1.34 Rivet Gun 1.35 Sledge Hammers 1.36 Sockets 1.37 Spanners 1.38 Vice grip 1.39 Wire Cutters 1.40 Wood Planners

	1.13 Pliers. 1.14 Scriber. 1.15 Scraper. 1.16 Screw drivers. 1.17 Dividers. 1.18 Trammels. 1.19 Surface plate 1.20 Marking table. 1.21 Height gauge. 1.22 Layout tools. 1.23 Tap sets. 1.24 Die sets. 1.25 Tap handle 1.26 Die handle 1.27 Hacksaw 1.28 Paint Brushes	1.41 Hand drill machine. 1.42 Hand grinding machine. 1.43 Pedestal drill. 1.44 Powered screwdriver. 1.45 Hand shear. 1.46 Clamps 1.47 Jacks. 1.48 Soldering iron. 1.49 Allen wrenches. 1.50 Draft punches
2. Power tools	2.1 Power drills 2.2 Power rivet gun. 2.3 Hand grinders 2.4 Pneumatic wrenches 2.5 Press machine 2.6 Jack hammer	2.7 Planers 2.8 Pedestal drills
3. Safety precautions	3.1 Use of appropriate PPEs. 3.2 Proper hand, feet and eye coordination 3.3 Safe condition of electrical outlets, cords and lamps 3.4 Working environment 3.5 Safe operating condition of hand tools and power tools. 3.6 Awareness to OHS requirements	
4. Measuring instruments	4.1 Measuring tape 4.2 Steel rule 4.3 Meter rule 4.4 Outside & inside caliper 4.5 Protractors' 4.6 Tri-square 4.7 Sprit level 4.8 Vernier caliper 4.9 Micrometer 4.10 Simple protractor 4.11 Vernier protractor 4.12 Limit gauges 4.13 Snap gauges.	

Curricular Evidence Guide:

1. Underpinning Knowledge	1.1 Types of tools, functions and use 1.2 Types of Hand tools and their proper use and techniques 1.3 Types of Power tools, use and safe handling method 1.4 Technical application of tools 1.5 Procedures in the use of hand tools and power tools 1.6 Policies and procedures for occupational health and safety 1.7 Use of PPE 1.8 Handling of tools and equipment 1.9 Reporting and documentation 1.10 Preventive maintenance 1.11 Methods and techniques 1.12 Quality procedures

	1.13 Storage procedures
2. Underpinning Skills	2.1 Using appropriate hand tool for the job. 2.2 Observing safety precautions when using hand tools. 2.3 Using power tools correctly and safely in accordance to manufacturer is operating specification. 2.4 Checking condition of tools after use. 2.5 Applying appropriate lubricant on hand tools and power tools after use and prior to storage. 2.6 Inspecting and correcting or replacing defective tools, instruments, power tools and accessories. 2.7 Storing Tools and power tools safely in appropriate location.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. Promptness in carrying out activities. 3.3 Tidiness and timeliness. 3.4 Respect of peers, sub-ordinates and seniors in workplace. 3.5 Environmental concern. 3.6 Sincere and honest to duties.
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Different types of hand tools and power tools 4.3 Pens 4.4 Papers 4.5 Work books 4.6 Tools and power tools operating and maintenance manuals

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Using appropriate hand tool for the job. 1.2 Observing safety precautions when using hand tools. 1.3 Used power tools safely in accordance to manufacturer's operating specification. 1.4 Checking the condition of tools after use. 1.5 Appling appropriate lubricant on hand tools and power tools after use and prior to storage. 1.6 Inspecting and corrected or replaced defective tools, instruments, power tools and accessories. 1.7 Storing tools and power tools safely in appropriate location.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **CARRY OUT PRECISION CHECKS AND MEASUREMENTS**	**Nominal Duration:** 5 hrs.	**Unit Code:** SEIP-LIG-MIL-3-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to use graduated measuring instrument in the light engineering sector workplace. It specifically includes the tasks of selecting the job to be measured, selecting graduated measuring instrument, obtaining measurements, recording and communicating measurements, cleaning, maintaining and storing measuring instruments.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Select the job to be checked and measured	1.1 Job is selected for measuring and checking 1.2 Required **dimensional measurement** is determined in accordance with drawing/plan 1.3 Required **physical condition** is identified in accordance with drawing/plan 1.4 Required **geometrical dimension** is identified in accordance with drawing/plan 1.5 Job drawing is used to select the measuring instruments.
2. Select measuring and checking tool/instrument	2.1 Appropriate measuring instruments is selected in accordance with job requirement. 2.2 **Direct and indirect measuring instruments** and **checking instrument** are identified 2.3 Applications of measuring device is determined. 2.4 Usability and accuracy of measuring device is checked and verified. 2.5 Measuring device is prepared for measurement. 2.6 Fits, Tolerance, clearance and limits are identified according to job requirements.
3. Obtain measurements and checks	3.1 Measurements are obtained using appropriate measuring instrument. 3.2 **Systems of measurements** are identified and converted where necessary. 3.3 Measurement is kept accurately in accordance to specification 3.4 Measurement is checked against job requirement 3.5 Physical conditions are checked in accordance with job requirements 3.6 Geometrical dimensions are checked in accordance with job specifications
4. Record/communicate measurement and check results	4.1 Measurements are recorded in accordance with workplace procedure 4.2 Measurement is interpreted, recorded and communicated to authority
5. Clean, maintain and store measuring instruments.	5.1 Dust and dirt are removed from the measuring instruments 5.2 Condition of measuring instruments are checked 5.3 Appropriate lubricant is applied after use and prior to storage 5.4 Measuring instruments are checked and calibrated 5.5 Measuring instruments are stored in accordance with workplace procedure.

Range of Variables

Variable	Range

	May include but not limited to:
1. Dimensional measurement	1.1 Length 1.2 Width 1.3 Depth 1.4 Diameter 1.5 Radius 1.6 Height
2. Physical condition	2.1 Roughness 2.2 Color 2.3 Smoothness 2.4 Surface finish 2.5 Flatness
3. Geometrical dimension	3.1 Parallelism 3.2 Perpendicularity 3.3 Angularity 3.4 Concentricity 3.5 Eccentricity 3.6 Roundness 3.7 Circularity
4. Direct measuring instruments.	4.1 Set squares 4.2 Dial indicators 4.3 Steel tape 4.4 Steel rule 4.5 Meter rule 4.6 Calculator 4.7 Vernier slide caliper 4.8 Digital Vernier slide caliper 4.9 Micrometer (inch/millimeter) 4.10 Digital micrometer 4.11 Vernier bevel protractor 4.12 Sprit level 4.13 AVO meter(analogue/digital) 4.14 Thermometers 4.15 Water meter 4.16 Gas meter 4.17 Simple protractor
5. Indirect measuring instrument	5.1 Outside caliper 5.2 Inside caliper 5.3 Bevel tri-square 5.4 Telescoping gage 5.5 Straight edge 5.6 Sine bar 5.7 Trammel
6. Checking instrument.	6.1 Plug gauge 6.2 Snap gauge 6.3 Screw pitch gauge 6.4 Slip gauges 6.5 Feeler gauges 6.6 Screw pitch gauge 6.7 Slip gauge 6.8 Tri-square 6.9 Center gauge 6.10 Bevel tri-square
7. Systems of measurements	7.1 ISO standard 7.2 English system

	7.3 Metric system

Curricular Content Guide

1. Underpinning Knowledge	1.1 Difference between measuring and checking 1.2 Types of measuring tools and their applications 1.3 Types of checking tools and their applications 1.4 Geometrical dimensions and tolerances 1.5 Method, procedure and techniques when taking linear Measurements 1.6 Methods, procedures and techniques when checking physical conditions of work pieces 1.7 Methods, procedures and techniques when Checking geometrical dimensions of work pieces 1.8 Measurement conversion systems 1.9 Workplace record keeping procedures 1.10 Preventive maintenance for measuring and checking tools 1.11 Calibration and adjustment procedures for measuring and checking tools
2. Underpinning Skills	2.1 Determining required dimensional measurements, physical conditions and geometrical dimensions in accordance with drawing/plan and workplace specification 2.2 Measuring and checking linear and geometrical dimensions within the required tolerance in accordance to specification 2.3 Checking physical conditions using appropriate checking tool 2.4 Identifying and converting systems of measurements where necessary. 2.5 Recording measurements in accordance with workplace procedure 2.6 Interpreting and communicating measurement to authority 2.7 Applying appropriate lubricant on measuring and checking tools and instruments after use and prior to storage 2.8 Checking condition of measuring instruments, calibrating and storing in accordance with workplace procedure
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.
4. Resource Implications	4.1 Workplace (simulated or actual) 4.2 Different types of graduated measuring and checking instruments 4.3 Pens 4.4 Papers 4.5 Work books 4.6 Measuring tools operating and maintenance manual.

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate:

	1.1 Determined required dimensional measurements, physical conditions and geometrical dimensions in accordance with drawing/plan and workplace specification 1.2 Measured and checked linear and geometrical dimensions within the required tolerance in accordance to specification 1.3 Checked physical conditions using appropriate checking tool 1.4 Identified and converted systems of measurements where necessary. 1.5 Recorded measurements in accordance with workplace procedure 1.6 Interpreted and communicated measurement to authority 1.7 Applied appropriate lubricant on measuring and checking tools and instruments after use and prior to storage 1.8 Checked condition of measuring instruments, calibrated and stored in accordance with workplace procedure
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **APPLY QUALITY SYSTEMS AND PROCEDURES**	**Nominal Duration:** 5 hrs.	**Unit Code:** SEIP-LIG-MIL-4-S
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to apply quality systems and procedures. It specifically includes the tasks of working within quality system, applying and monitoring quality system improvement in the workplace, holding responsibility for quality work and applying standard procedures for each job.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Work within quality system	1.1 Instructions and procedures are followed strictly and duties are performed in accordance with demand of **quality improvement system.** 1.2 Conformance to specifications is ensured. 1.3 Defects are detected and reported to authority according to standard operating procedures. 1.4 Customer's satisfaction is ensured in performing an operation or quality of product or services.
2. Apply and monitor quality system improvement in the workplace	2.1 Performance measurement systems are identified 2.2 Performance is assessed at regular interval. 2.3 Specifications and standard operating procedures are established and identified. 2.4 Defects are detected and reported according to standard operating procedures. 2.5 Process improvement procedures are applied 2.6 Quality of product is checked and verified.
3. Hold responsible for work quality	3.1 Concept of supplying product or service to meet the **customer quality requirements** is understood and accordingly applied. 3.2 Responsibility is taken for quality work.
4. Apply standard procedures for each job.	4.1 **Quality control and quality assurance** system procedures for each job are followed. 4.2 Conformance to specification is ensured in every case at all situations.

Range of Variables

Variable	Range May include but not limited to:
1. Quality improvement system	A system comprising some or all of the following elements: 1.1 Quality inspection 1.2 Quality control. 1.3 Quality improvement. 1.4 Quality assurance
2. Customer quality requirements.	2.1 Appropriateness of product 2.2 Appearance 2.3 Durability. 2.4 Grade or quality design 2.5 Usability life span 2.6 Conformance to Quality 2.7 Reliability 2.8 Maintainability

3. Quality control and quality assurance	3.1 Quality control 3.1.1 Product 3.1.2 Reactive 3.1.3 Line function 3.1.4 Find the defects 3.1.5 Walk through 3.1.6 Testing 3.1.7 Inspection 3.1.8 Checkpoint Review	3.2 Quality Assurance 3.2.1 Process 3.2.2 Pro-active 3.2.3 Staff function 3.2.4 Prevent the defects 3.2.5 Quality audit 3.2.6 Defining process 3.2.7 Selection of tools 3.2.8 Training

Curricular Evidence Guide

1. Underpinning Knowledge	1.1 The reasons why good quality should be maintained and poor quality should be eliminated 1.2 Meaning of the key terms - quality, quality assurance, quality control, quality inspection, quality improvement and total quality control. 1.3 Process and procedures for improving and maintaining quality 1.4 Procedures for addressing defects. 1.5 Record keeping within the quality improvement system in workplace 1.6 Factors, which affect successful implementi0n of the quality systems and procedures.
2. Underpinning Skills	2.1 Maintaining good quality 2.2 Eliminating poor quality 2.3 Understanding the meaning of the key terms - quality, quality assurance, quality control, quality inspection, quality improvement and total quality control. 2.4 Improving and maintaining quality 2.5 Addressing defects and procedures 2.6 Recording within the quality improvement system in workplace. 2.7 Implementing quality systems and procedures
3. Under pinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.
4. Resource Implications	The following resources must be provided: 4.1 Workplace 4.2 Tools and equipment appropriate to maintain workplace 4.3 Materials relevant to the proposed activity 4.4 Relevant drawings, manuals, codes, standards and reference material

Assessment Evidence Guide:

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Followed instructions and procedures strictly 1.2 Performed duties in accordance with demand of quality system 1.3 Ensured conformance to specifications 1.4 Detected defects and reported to authority in accordance to

	standard operating procedures. 1.5 Understood concept of supplying product or service to meet the customer quality requirements 1.6 Held responsible for quality work 1.7 Followed quality control and quality assurance system procedures for each job
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

C. Occupation Specific (Core) Competencies

Unit of Competency: **PERFORM BENCH WORKING OPERATIONS**	**Nominal Duration:** 50hrs.	**Unit Code:** SEIP-LIG-MIL-1-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required of a worker to perform bench working operations. It specifically includes work tasks of gathering tools, equipment and materials for bench work, performing bench work, carrying out drilling and reaming operations, carrying out manual thread cutting and damage bolt and tap removal, performing off-hand grinding operation, performing basic welding operation, performing heat-treatment processes and cleaning and store the tools and equipment.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Gather tools, equipment and materials for bench work	1.1 **PPE** are selected and used. 1.2 **Tools, Equipment & Materials** are selected for **bench work** and gathered as per job requirement specified in the drawing. 1.3 Layout is performed and marked in accordance with drawing.
2. Perform bench work	2.1 Work piece are clamped in **work holding devices** to avoid damage and accidents 2.2 Work pieces are cut, chipped and filed within as specified in the drawing. 2.3 Broken or dull hacksaw blades, chisel and file are replaced according to requirements. 2.4 Measurement of work piece is checked according to standard work procedures.
3. Carry out drilling and reaming operations	3.1 Good drill bit and reamer is collected from the store. 3.2 Bench drill machine is prepared for drilling operation. 3.3 Drilling holes are performed according to recommended sequence. 3.4 Reaming holes are performed according to recommended sequence. 3.5 Coolant is used to reduce heat of drill and reamer and prevent damage.
4. Carry out manual thread cutting and tap removal	4.1 Tap is selected to cut internal **thread** and die is selected to cut external thread accordance with job requirement 4.2 Work piece is held with support as required. 4.3 Thread is cut to checked by gage or mating screw given in the drawing. 4.4 Internal thread is cut in accordance with the recommended tapping Sequence. 4.5 External thread is cut in accordance with the recommended die operation sequence. 4.6 Damaged bolt and stud is removed by screw extractor as required. 4.7 Damaged tap is removed by tap extractor as required.
5. Perform off-hand grinding operation	5.1 Work piece is hold and clamped in accordance with standard work procedures 5.2 Appropriate grinding disc is selected as per job requirement. 5.3 Grinding operation is performed conform with specifications.
6. Perform basic welding operation	6.1 Selected and used **welding** tools and **equipment**

	6.2 Arc welding is performed of different position 6.3 Gas welding is performed of different position 6.4 Brazing and soldering are performed 6.5 Gas cutting is performed.
7. Perform heat treatment processes	7.1 Selected heat treatment tools equipment and materials. 7.2 Performed **heat-treatment process**
8. Clean and store tools and equipment	8.1 Hand tools and equipment are maintained and cleaned as per instruction manual. 8.2 Work place is cleaned in accordance with environmental requirement. 8.3 Tools and equipment are stored safely in appropriate location according to standard workshop procedures. 8.4 Waste materials are disposed in proper place.

Range of Variables

Variable	Range May include but not limited to:	
1. PPE	1.1 Safety helmet 1.2 Safety shoes 1.3 Hand gloves 1.4 Apron	
2. Tools, equipment & materials	2.1 Hand Tools 2.1.1 Tool box 2.1.2 Layout tools 2.1.3 Hacksaw 2.1.4 Chisel 2.1.5 Files 2.1.6 Drills, reamer, tap and die 2.1.7 Tap and screw extractors 2.1.8 Tri-squire 2.2 Measuring tools 2.2.1 Steel rule 2.2.2 Steel tape 2.2.3 Meter rule 2.2.4 Vernier caliper 2.2.5 Vernier height gauge 2.2.6 Micrometer 2.2.7 Vernier bevel protector. 2.3 Checking tools. 2.3.1 Bevel tri-squire. 2.3.2 Straight edge. 2.3.3 Dial indicator 2.3.4 Slip gauge. 2.3.5 Plug gauge 2.3.6 Snap gauge	2.3.7 Ring gauge 2.3.8 Filler gauge 2.3.9 Telescoping gauge 2.3.10 Screw gauge 2.3.11 Center gauge 2.3.12 Sine bar 2.4 Equipment 2.4.1 Marking table 2.4.2 Drill press 2.4.3 Hand grinder 2.4.4 Surface plate 2.4.5 Surface gauge 2.4.6 Anvil. 2.4.7 Swage block 2.5 Materials 2.5.1 Mild steel 2.5.2 Medium carbon steel. 2.5.3 Cast iron. 2.5.4 Brass 2.5.5 Copper 2.5.6 Bronze 2.5.7 Gun metal 2.5.8 Kerosene oil 2.5.9 Cutting fluid.
3. Bench work	3.1 Layout and marking 3.2 Cutting 3.3 Chipping	

	3.4 Filing 3.5 Drilling 3.6 Reaming 3.7 Thread cutting 3.8 Off-hand grinding 3.9 Damage bolt and stud removing 3.10 Broken tool removing 3.11 Fitting 3.12 Forging 3.13 welding 3.14 Heat-treatment 3.15 Assembling
4. Work holding devices.	4.1 Clamps 4.2 Vices. 4.3 Surface plate. 4.4 Zig and fixture
5. Thread	5.1 British standard Whitworth thread (BSW- 55 degree thread angle) 5.2 Matric standard thread (M-series 60 degree thread angle)
6. Welding equipment	6.1 Arc welding machine. 6.2 Gas welding sets.
7. Heat-treatment process	7.1 Annealing process 7.1.1 Normalizing 7.1.2 Stress reliving. 7.2 Hardening process. 7.2.1 Heating 7.2.2 Quenching 7.2.3 Tempering. 7.3 Case Hardening process 7.3.1 Curb arising 7.3.2 Heating 7.3.3 Quenching 7.3.4 Tempering

Curricular Content Guide

1. Underpinning Knowledge	1.1 PPE used in performing bench works 1.2 Types of bench works tools, equipment and materials and their function. 1.3 Methods of Machine setting 1.4 Types and use of work holding devices 1.5 Drawing interpretation 1.6 Procedure in Grinding operations and safety requirements 1.7 Types of twist drills and nomenclature 1.8 Techniques of drilling and reaming hole. 1.9 Types of bench working processes and techniques 1.10 Types of welding processes and their application 1.11 Types of heat treatment process 1.12 Methods of heat treatment

2. Underpinning Skills	2.1 Selecting and using PPE 2.2 Selecting and gathering tools, equipment & materials 2.3 Preparing bench work machine, job holding devices and related tools and equipment. 2.4 Grinding appropriate disc is selected as per job requirement. 2.5 Extracting damage screw and tap. 2.6 Performing drill and ream hole. 2.7 Performing sawing, chipping, filling, taping and reaming. 2.8 Performing welding. 2.9 Performing heat-treatment. 2.10 Cleaning. Tools & equipment. 2.11 Disposing waste materials in designated place.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.
4. Resource Implications	The following resources MUST be provided: 4.1 Workplace 4.2 Tools, equipment and facilities appropriate to processes or activity. 4.3 Materials relevant to the proposed activity. 4.4 Relevant drawings, manuals, codes, standards and reference material.

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Clamped work pieces using appropriate work holding devices to avoid damage and accidents. 1.2 Cut, chipped and filed work pieces within in accordance with specification in the drawing. 1.3 Checked measurement of work piece according to standard working procedure 1.4 Performed drilling of holes and reaming following recommended sequence. 1.5 Cut threads and checked thread using thread pitch gauge 1.6 Performed grinding operation in accordance with workplace procedures 1.7 Performed welding operations 1.8 Performed heat-treatment process
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio

3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **CARRY OUT GRINDING OF CUTTING TOOLS**	**Nominal Duration:** 20 hrs.	**Unit Code:** SEIP-LIG-MIL-2-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to carry out grinding of milling cutting tools and drill bits. It includes the tasks of determining the job requirement, selecting of grinding wheels and accessories, performing tool grinding of milling cutters, performing drill bit grinding and cleaning/maintaining the workplace.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Determine job requirement	1.1 Drawings are interpreted to grind tools confirming to the specifications 1.2 Tool holding devices are selected according to the requirements of the operation. 1.3 milling cutter and **tool blanks** are selected according to requirements of the milling operation.
2. Select grinding wheels and accessories	2.1 **PPE** is selected & used. 2.2 Performed routine maintenance and prepared the machine for required operation. 2.3 Pedestal grinding machine is selected to grind lathe tools and drill bits. 2.4 accessories are selected to appropriate to the requirements of the operation. 2.5 **Grinding wheels** are selected, inspected, dressed according to worksite procedures. 2.6 Machine guards, coolant and dust collection devices are checked according to worksite procedure.
3. Perform tool grinding of Milling cutters	3.1 Universal tool grinding machine is selected in accordance with worksite procedures. 3.2 Milling cutter and tool blank is held or clamped to avoid damage. 3.3 Coolant is used to reduce heat of tool and prevent damage. 3.4 Grinding of tool blank and milling cutter accordance to **profile angles** of form and milling cutter tools is performed as per specification mentioned in the drawing.
4. Perform drill bit grinding	4.1 **Grinding machine** is selected and prepared for grind drill bits 4.2 **Drill bits** and **holding devices** are collected as per requirements. 4.3 Grinding wheel is dressed according to work site procedure. 4.4 Coolant is used to reduce heat of drill and to prevent damaged. 4.5 Grinding of drill bit accordance to the rake angle of drill bit performed as per specification.
5. Clean/maintain the workplace	5.1 Tools and equipment are cleaned 5.2 Workplace is cleaned 5.3 Waste materials are disposed in its designated/proper place

Range of Variables

Variable	Range May include but not limited to:
1. Tool blank	1.1 High speed steel tool blank (H.S.S). 1.2 Carbon steel tool blank.

2. PPE	Dust musk. Goggles. Safety shoes. Apron
3. Grinding wheels	3.1 Milling cutter grinding: 3.1.1 High speed steel cutters- 38A46-K5VG 3.1.2 Cemented carbides cutters- 39C100-J8Vk 3.1.3 Diamond wheel- D150-N50B 3.2 Drill grinding 3.2.1 Large brills- A46-M5VBE 3.2.2 Small drills- A80-L5VBE
4. Profile angle	4.1 Back/rake angle. 4.2 Front clearance angle. 4.3 Side rake angle 4.4 Side clearance angle. 4.5 End cutting-edge angle. 4.6 Side cutting edge angle
5. Grinding machine	5.1 Bench grinding machine. 5.2 Pedestal grinding machine. 5.3 Universal tools and cutter grinding machine
6. Drill bits.	6.1 Straight shanks twist drill 6.2 Taper shank twist drill.
7. Holding devices.	7.1 Drill grinding gauge 7.2 Drill grinding attachment. 7.3 Universal vice.

Curricular Content Guide

1. Underpinning Knowledge	1.1 Procedure and technique in dressing of grinding wheels 1.2 Procedure in adjusting the tool grinding machine and safety precautions 1.3 Methods 0f holding and clamping of tool blank 1.4 Safety precautions in tool grinding operations 1.5 Procedure and technique of grinding of tool blank used as milling cutter 1.6 Types of Drill bit cutting edges/profile with reference to the material to be drilled 1.7 Techniques of drill bit grinding 1.8 Types of milling cutter and their applications 1.9 holding devices for tool grinding operations 1.10 Purpose of coolant in grinding of cutting tools 1.11 Different types of grinding machine and their function 1.12 Types of grind wheels and their applications
2. Underpinning Skills	2.1 Selecting and inspecting grinding wheels 2.2 Dressing of grinding wheels according to worksite procedures 2.3 Adjusting of grinding machine in accordance with work site procedures. 2.4 Holding tool blank and clamping securely to avoid damage. 2.5 Performing grinding of tool blank in accordance with specified profile angles of milling cutter 2.6 Performing drill bit grinding in accordance with type of work material to be worked upon 2.7 Collecting milling cutter, drill bits and holding devices as per

	requirements. 2.8 Using coolant to reduce heat of drill and to prevent material damaged and weakening
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.
4. Resource Implications	The following resources must be provided: 4.1 Workplace 4.2 Tools, equipment and facilities appropriate to processes or activity. 4.3 Materials relevant to the proposed activity. 4.4 Equipment and outfits appropriate in applying safety measures. 4.5 Relevant drawings, manuals, codes, standards and reference material.

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Selected and inspected grinding wheels and dressed according to worksite procedures 1.2 Adjusted grinding machine in accordance with work site procedures. 1.3 Held tool blank and clamped securely to avoid damage. 1.4 Performed grinding of tool blank in accordance with specified profile angles of milling cutter 1.5 Performed drill bit grinding in accordance with type of work material to be worked upon 1.6 Collected milling cutter, drill bits and holding devices as per requirements. 1.7 Used coolant to reduce heat of drill and to prevent material damaged and weakening
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **PERFORM MILLING MACHINE OPERATION**	**Nominal Duration:** 30 hrs.	**Unit Code:** SEIP-LIG-MIL-3-O
Unit Descriptor: This unit covers the knowledge, skill and attitude required to perform milling machine operation. It specifically includes the tasks of identifying types of milling machine, identifying different parts of the milling machine, determining operating parameters of milling machine, identifying and setting the milling accessories and attachment, identifying and setting different milling cutters, determine methods of milling operation and clean and maintain milling machine components, tools and accessories		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify different types of milling machine	1.1 **PPE** is selected & used. 1.2 Different **types of milling machine** are selected to identifying in the workplace. 1.3 Machine is degreased in accordance with workplace requirements. 1.4 Machine is handled and used according to the instruction of machine manual. 1.5 Machine electrical connecting switch are identified and used.
2. Identify different parts of the milling machine	2.1 **Main parts** of the different milling machine are identified. 2.2 **Different parts of milling machine** are identified and explained its functions 2.3 Milling arbors and adopters are used for holding the cutters 2.4 Millings vises are used for holding the job material. 2.5 Handled and care and maintained of the parts.
3. Determine operating parameters of milling machine	3.1 **Operating parameters** of milling machine is identified in accordance to work requirements 3.2 RPM is selected and set according to the machine RPM selecting table chart as per the milling cutter diameter and job material. 3.3 Cutting speed is calculated according to the cutter diameter and RPM of the cutter. 3.4 Feed is set by the feed change lever. 3.5 Depth of cut is calculated according to the RPM and feed of the machine.
4. Identify and set the milling accessories and attachment	4.1 **Milling accessories** and **attachment** are identified. 4.2 Milling accessories and attachment are set appropriate of the requirements to the operations.
5. Identify and set different milling cutter	5.1 **Milling cutters** are identified and selected according to their holding features. 5.2 Hollow type cutters are set on the arbor and called it arbor cutter. 5.3 Shank type cutters are set taper sleeves or adopters. 5.4 Milling cutters specifications are identified**.**
6. Determine methods of milling operation	6.1 **Milling operating method** is determined according to the feeding direction and cutter rotations. 6.2 Milling methods are selected according to the requirements to the job specifications.
7. Clean and maintain milling machine components, tools and accessories	7.1 Milling Machine, cutters, accessories and attachments are cleaned. 7.2 Table, vise, fixture, accessories and attachment are cleaned before leaving the machine. 7.3 A T-slot scraper is used for cleaning machine table T-slots.

	7.4 **Preventive maintenance** schedules are followed. 7.5 Oil or grease the machine regularly with the lubricant recommended. 7.6 Work place is cleaned 7.7 Waste materials are disposed in proper place. 7.8 Milling cutters, accessories and attachment are stored safely in appropriate location according to standard place and procedures.

Range of Variables

Variable	**Range** May include but not limited to:
1. PPE	1.1 Dust musk. 1.2 Machine goggles. 1.3 Safety shoes. 1.4 Apron
2. Types of milling machine.	2.1 Bed type milling machine 2.1.1 Simplex milling machine. 2.1.2 Duplex milling machine. 2.1.3 Triplex milling machine. 2.2 Column and knee type milling. 2.2.1 Hand milling machine 2.2.2 Plain milling machine. 2.2.3 Universal milling machine. 2.2.4 O-universal milling machine. 2.2.5 Vertical milling machine. 2.3 Plainer type milling machine. 2.4 Special types milling machine. 2.4.1 Tracer controlled milling machine. 2.4.2 Thread cutting milling machine. 2.4.3 CNC milling machine.
3. Main parts of milling machine.	3.1 Head. 3.2 Column. 3.3 Table. 3.4 Saddle. 3.5 Knee. 3.6 Base.
4. Different parts of milling machine.	4.1 Overarm. 4.2 Arbor supporting bracket. 4.3 Spindle nose. 4.4 Hand cross feed. 4.5 Hand vertical feed. 4.6 Speed change levers. 4.7 Feed driving shaft. 4.8 Feed change levers. 4.9 Table feed actuating lever. 4.10 Feed trip. 4.11 Rapid power feed control. 4.12 Handle table feed. 4.13 Starting lever. 4.14 Wheel for moving overarm. 4.15 Feed reversing lever. 4.16 Tube to deliver cutting fluid to reservoir in base.
5. Operating parameters	5.1 RPM

	5.2 Cutting speed 5.3 Feed and 5.4 Depth of cut
6. Milling accessories	6.1 Machine vise. 6.2 Swivel base. 6.3 Angle plate. 6.4 Dividing plate. 6.5 Adapter plate. 6.6 3-Jaw universal chuck. 6.7 Support back plate. 6.8 Stepped clamping shoe. 6.9 Collet chuck. 6.10 3-Jaw drill chuck. 6.11 Shell end mill arbor. 6.12 Boring and facing head. 6.13 Short arbor. 6.14 Long arbor. 6.15 Adaptor with collect chuck. 6.16 Quick release vice.
7. Milling attachment	7.1 Vertical milling attachment. 7.2 Arbor support. 7.3 Right angle head. 7.4 Angle attachment set. 7.5 T-slot cleaner. 7.6 Stainless steel T-slot shop brush. 7.7 Chip hook. 7.8 Wiper kit. 7.9 Milling machine drawbar. 7.10 Quill feed handle. 7.11 Milling machine-tooling package. 7.12 Index head. 7.13 Rotary table/ circular milling attachment. 7.14 Rack milling attachment. 7.15 Horizontal milling attachment. 7.16 Grinding milling attachment. 7.17 Gear hobbling attachment.
8. Milling cutters.	8.1 Arbor type cutters. 8.1.1 Side and face cutter. 8.1.2 Slotting cutter. 8.1.3 Single angle cutter. 8.1.4 Double angle cutter. 8.1.5 Convex cutter. 8.1.6 Cone cave cutter 8.1.7 Slitting saw cutter. 8.1.8 Corner radios cutter. 8.1.9 Shell end mill cutter. 8.1.10 Face milling cutter. 8.1.11 Involute gear cutter. 8.1.12 Gear hob cutter. 8.1.13 Slab milling. 8.1.14 Staggered tooth cutter. 8.1.15 Inserted blade cutter. 8.1.16 Inserted carbide tips cutter. 8.1.17 Woodruff cutter. 8.2 Shank type cutters 8.2.1 Taper shank cutter.

	8.2.2 Parallel shank cutter. 8.2.3 T-slot cutter. 8.2.4 Slot drill 8.2.5 End mill cutter. 8.2.6 Milling bits. 8.2.7 Carbide end mill. 8.2.8 Roughing end mill. 8.2.9 Dovetail cutter. 8.2.10 Ball nose cutter.
9. Milling methods.	9.1 Up or conventional milling methods. 9.2 Down or climb milling method
10. Preventive maintenance	10.1 Oil and grease the machine sliding parts; daily, weekly and Monthly 10.2 Coolant tank scheduled cleaning 10.3 electrical fixture & connections regularly Check up 10.4 Cleaning the table and vise after each operation.

Curricular Content Guide

1. Underpinning Knowledge	1.1 Milling machine operating manual and handling 1.2 Electrical circuit and operating switches of milling machines 1.3 Rpm selection and setting procedures 1.4 Rpm selection table/chart in relation to milling cutter diameter and material of work piece. 1.5 Cutting speed calculation and application 1.6 Feed rate-setting procedure using the feed change lever. 1.7 Depth of cut application in conjunction with rpm and machine feed 1.8 Types and selection of milling cutters 1.9 Functions of milling accessories and attachment 1.10 Procedure and methods of setting milling accessories and attachment 1.11 Milling methods in accordance with feeding direction and cutter rotations 1.12 Milling methods in accordance with job requirements and specifications.
2. Underpinning Skills	2.1 Handling and using milling machine in accordance with machine operating manual 2.2 Identifying machine electrical operating switches 2.3 Selecting and setting rpm in accordance with machine rpm selection table/chart and considering the milling cutter diameter and material of work piece. 2.4 Calculating and applying the cutting speed in accordance with diameter and rpm of the cutter. 2.5 Setting feed rate using the feed change lever. 2.6 Applying depth of cut according to the rpm and feed of the machine. 2.7 Identifying and selecting milling cutters according to their holding features. 2.8 Identifying milling accessories and attachment 2.9 Setting milling accessories and attachment appropriate to the requirements of the operation 2.10 Determining milling methods according to the feeding direction and cutter rotations.

	2.11 Selecting milling method according to the requirements to the job specifications
2. Underpinning Attitudes	2.1 Commitment to occupational health and safety practices 2.2 Communication with peers, sub-ordinates and seniors in workplace 2.3 Promptness in carrying out activities. 2.4 Tidiness and timeliness. 2.5 Respect of peers, sub-ordinates and seniors in workplace. 2.6 Environmental concern. 2.7 Sincere and honest to duties.
3. Resource Implications	The following resources MUST be provided: 3.1 Workplace. 3.2 Tools, equipment and facilities appropriate to processes or activity. 3.3 Materials relevant to the proposed activity. 3.4 Equipment and outfits appropriate in applying safety measures. 3.5 Relevant drawings, manuals, codes, standards and reference material.

Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Handled and used milling machine in accordance with machine operating manual 1.2 Identified machine electrical operating switches 1.3 Selected and set rpm in accordance with machine rpm selection table/chart and considering the milling cutter diameter and material of work piece. 1.4 Calculated and applied the cutting speed in accordance with diameter and rpm of the cutter. 1.5 Set feed rate using the feed change lever. 1.6 Applied depth of cut according to the rpm and feed of the machine. 1.7 Identified and selected milling cutters according to their holding features. 1.8 Identified milling accessories and attachment 1.9 Set milling accessories and attachment appropriate to the requirements of the operation 1.10 Determined milling methods according to the feeding direction and cutter rotations. 1.11 Selected milling method according to the requirements to the job specifications.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **PERFORM INDEXING OPERATION USING INDEXING HEAD**	**Nominal Duration:** 30 hrs.	**Unit Code:** SEIP-LIG-MIL-4-O
Unit Descriptor: This unit covers the knowledge, skills and attitudes required to perform indexing operation using indexing head. It includes the tasks of identifying different parts of indexing head. Setting index head on milling machine, identifying different types of indexing methods, performing different indexing methods and cleaning and storing tools and equipment.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Identify different parts of index head	1.1 Index head is selected and collected from the store. 1.2 **Different parts of index head** are identified and demonstrated.
2. Set index head on milling machine	2.1 Index head and tailstock is lined up and bolted to the machine table at the right-hand end. 2.2 Index head consists essentially of a spindle which is keyed, inside the head a 40-tooth worm wheel. 2.3 The wheel is meshed with a single-threaded worm. 2.4 The spindle is projected from the front of the head and has a crank and handle attached. 2.5 The head spindle is bored through with a taper hole and is also screwed on its end, so that a chuck is fixed on for holding work not suited is carried on center. 2.6 Work is held on centers a tailstock is available which is located, for lining-up purposes, in the same tee slot as the head and bolted down at a suitable position along the table. 2.7 The head is rotated so that its spindle is inclined at any angle between the horizontal and the vertical to make it adaptable for conical or end work. 2.8 The tailstock is obtained small inclinations has a limited up and down adjustment.
3. Identify different types of indexing methods	3.1 Different types of **indexing methods** are identified. 3.2 Calculations are completed using the indexing formula of different methods of indexing.
4. Perform different indexing methods	4.1 **PPE** is selected and used. 4.2 Index head are selected according to the requirement of the job. 4.3 Different indexing methods are performed according to job requirement of the specifications.
5. Clean and store tools and equipment	5.1 Index head are cleaned. 5.2 Work place is cleaned. 5.3 Waste materials are disposed in proper place.

Range of Variables

Variable	Range May include but not limited to:
1. Different parts of index head.	1.1 Index head 1.2 Tailstock 1.3 Index plate 1.4 Index crank

	1.5 Sector arms 1.6 Crank pin 1.7 Plunger 1.8 Worm spindle 1.9 Single start worm 1.10 40 teeth worm wheel 1.11 Main spindle 1.12 Taper hole 1.13 End for attachment of work. 1.14 Driving plate 1.15 Handle 1.16 Concentric hole circles 1.17 Center 1.18 Plunger for direct indexing 1.19 Direct indexing plate 1.20 Swivel block
2. Indexing methods.	2.1 Direct indexing 2.2 Simple indexing 2.3 Angular indexing 2.4 Compound indexing 2.5 Differential indexing
3. PPE	3.1 Dust musk. 3.2 Machine goggles. 3.3 Safety shoes. 3.4 Apron

Curricular Content Guide

1. Underpinning Knowledge	1.1 Uses of different parts of index head 1.2 Methods of indexing 1.3 Calculations using the indexing formula of different methods of indexing. 1.4 Index head selection according to the requirement of the job. 1.5 Procedure of performing indexing methods 1.6 Types of index head and their application 1.7 Parts of index head and their functions 1.8 Describing of different methods of indexing. 1.9 Application of index head 1.10 Calculation of different indexing methods 1.11 Setting of index head on milling table.
2. Underpinning Skills	2.1 Lining up and bolting of indexing head to the machine table at the right-hand end. 2.2 Identifying the parts of indexing head 2.3 Locking the indexing head to the spindle 2.4 Projecting the spindle from the front of the head with a crank and handle attaching. 2.5 Fixing the head through the bore with a taper hole and screwing on its end to fixed the chuck for holding the work 2.6 Holding the work on centers of the tailstock for locating, and lining-up purposes, in the same tee slot as the head and bolting down at a suitable position along the table.

	2.7 Rotating the head so that its spindle is inclining at any angle between the horizontal and the vertical to make it adaptable for conical or end work. 2.8 Obtaining small inclinations of the tailstock for a limiting up and down adjustment. 2.9 Selecting index head according to the requirement of the job. 2.10 Performing different indexing methods according to job requirement and specifications.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace 3.3 Promptness in carrying out activities 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties
4. Resource Implications	The following resources MUST be provided: 4.1 Workplace 4.2 Tools, equipment and facilities appropriate to processes or activity 4.3 Materials relevant to the proposed activity 4.4 Equipment and outfits appropriate in applying safety measures. 4.5 Relevant drawings, manuals, codes, standards and reference material

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Identified and demonstrated the use of different parts of index head 1.2 Applied different indexing methods 1.3 Completed calculations using the indexing formula of different methods of indexing. 1.4 Selected index head according to the requirement of the job. 1.5 Performed different indexing methods in accordance with job requirements/specifications
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **PERFORM PLAIN, SIDE, FACE, GANG AND STRADDLE MILLING OPERATION**	**Nominal Duration:** 60 hrs.	**Unit Code:** SEIP-LIG-MIL-5-O
Unit Descriptor: This unit covers the knowledge, skill and attitude required to perform plain, side and face milling operation. It specifically includes the tasks of determining job requirement, performing plain milling, performing side milling, performing face milling and cleaning and storing the tools and equipment.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Determine job requirement	1.1 Drawings and specification are interpreted in relation to plain, side and face milling operation 1.2 **Milling machine** accessories and attachment are used as appropriate to the requirements of the operation. 1.3 Sequence of operation is determined to perform milling work according to specifications. 1.4 Required materials are selected according to job requirements. 1.5 Cutting fluid is used according to the instruction of manual. 1.6 Milling cutters are selected according to the requirements of the job and the operation. 1.7 **PPE** is selected and used. 1.8 Safe work practices observed and personal protective equipment (PPE) worn as required for the work performed
2. Perform Plain milling	2.1 The horizontal/vertical machine with a vise on the table and a cylindrical plain **milling cutter** on the horizontal/vertical arbor is set according to job requirement. 2.2 RPM, cutting speed, feed and depth of cut 2.3 Machine performance is checked conforming to the job requirement. 2.4 Coolant is applied to prevent over heating of work piece and cutting tool. 2.5 Plain milling operation is performed by cylindrical plain milling cutter and used conventional milling methods to produced flat surface on job in which the cutter axis and job axis are parallel. 2.6 Job is checked/measured for conformance to specification using appropriate techniques, measuring tools, and equipment.
3. Perform side milling	3.1 The horizontal/vertical machine with a vise on the table and a side milling/end milling cutter on the horizontal/vertical arbor or adopter is set up according to workplace requirements. 3.2 RPM, cutting speed, feed and depth of cut are calculated as per job requirement. 3.3 Machine performance is checked conforming to the job requirement. 3.4 Coolant is applied to prevent over heating of work piece and cutting tool. 3.5 Side milling operation is performed by side milling/end milling cutter and to produce flat surface, slots, grooves or finishing the edges of the work pieces. 3.6 Job is checked/measured for conformance to specification using appropriate techniques, **measuring tools, tools and equipment.**

4. Perform face milling	4.1 The horizontal/vertical machine with a vise on the table and a face milling cutter on the horizontal/vertical arbor is set according to the job requirement 4.2 RPM, cutting speed, feed and depth of cut are calculated as per job requirement. 4.3 Machine performance is checked conforming to the job requirement. 4.4 Coolant is applied to prevent over heating of work piece and cutting tool. 4.5 Face milling operation is carried out for producing a flat surface, which is perpendicular to the axis of rotating face milling cutter. 4.6 Job is checked/measured for conformance to specification using appropriate techniques, measuring tools, tools and equipment.
5. Perform gang and straddle milling	5.1 The horizontal milling machine with a vise on the table and a face milling cutter on the horizontal arbor is set up according to job requirement. 5.2 RPM, cutting speed, feed and depth of cut are calculated as per job requirement. 5.3 Machine performance is checked conforming to the job requirement. 5.4 Coolant is applied to prevent over heating of work piece and cutting tool. 5.5 Gang and straddle milling operation is carried out for producing a flat surface, which is perpendicular to the axis of rotating face milling cutter. 5.6 Job is checked/measured for conformance to specification using appropriate techniques, measuring tools, tools and equipment
6. Clean and store the tools and equipment	6.1 Tools, equipment and milling machine are cleaned. 6.2 Work place is cleaned 6.3 Waste materials are disposed in proper place. 6.4 Tools, equipment and finished job are stored safely in appropriate location according to standard place and procedures.

Range of Variables

Variable	**Range** May include but not limited to:
1. Milling machine	1.1 Vertical milling machine. 1.2 Horizontal milling machine.
2. PPE	2.1 Dust musk. 2.2 Safety goggles. 2.3 Safety shoes. 2.4 Apron
3. Milling cutters	3.1 Side milling cutter. 3.2 Plain milling cutter. 3.3 Face milling cutter. 3.4 End milling cutter 3.5 Horizontal milling cutter
4. Measuring tools	4.1 Steel rule. 4.2 Vernier caliper. 4.3 Vernier height gauge. 4.4 Dial indicator. 4.5 Bevel tri-square.
5. Tools & equipment.	5.1 Tools 5.1.1 Vise handle.

	5.1.2 Parallel bar. 5.1.3 Soft hammer. 5.1.4 Wrenches. 5.1.5 5.2 Equipment 5.2.1 Machine vise. 5.2.2 Universal vise. 5.2.3 Collect chuck. 5.2.4 Adaptor. 5.2.5 Short and long arbor. 5.2.6 Drawbar. 5.2.7 Vertical milling attachment.

Curricular Content Guide

1. Underpinning Knowledge	1.1 Interpretation of Drawings and specification for operation of plain, side and face milling 1.2 Types and use of Milling accessories and attachment appropriate to the requirements of the operation. 1.3 Sequence of operation to produce milling jobs according to specifications. 1.4 Material specification and selection according to job requirements. 1.5 Types and properties of Cutting fluid 1.6 Advantages of the use of cutting fluids 1.7 Types of Milling cutters and their applications 1.8 Selection of milling cutters based on requirements of the job and the operation. 1.9 Safe working practices when performing milling operations 1.10 Personal Protective Equipment used in milling operations
2. Underpinning Skills	2.1 Setting up the horizontal/vertical machine with a vise on the table and a cylindrical plain, side milling/end milling, face milling cutter on the horizontal/vertical arbor 2.2 Calculating RPM, cutting speed, feed rate and depth of cut 2.3 Checking machine performance in conformity to the job requirement. 2.4 Applying coolant to prevent over heating of work piece and cutting tool. 2.5 Performing plain milling operation using cylindrical plain milling cutter and using conventional milling methods to produced flat surface on job in which the cutter axis and job axis are parallel. 2.6 Performing side milling operation using side milling/end milling cutter and to produce flat surface, slots, grooves or finishing the edges of the work pieces. 2.7 Carrying out face milling operation to produce a flat surface, which is perpendicular to the axis of rotating face milling cutter. 2.8 Checking/measuring Job for conformance to specification using appropriate techniques, measuring tools, tools and equipment.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace 3.3 Promptness in carrying out activities 3.4 Tidiness and timeliness

	3.5 Respect of peers, sub-ordinates and seniors in workplace 3.6 Environmental concern 3.7 Sincere and honest to duties
4. Resource Implications	The following resources MUST be provided: 4.1 Workplace 4.2 Tools, equipment and facilities appropriate to processes or activity 4.3 Materials relevant to the proposed activity 4.4 Equipment and outfits appropriate in applying safety measures. 4.5 Relevant drawings, manuals, codes, standards and reference material

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1.1 Set up the horizontal/vertical machine with a vise on the table and a cylindrical plain, side milling/end milling, face-milling cutter on the horizontal/vertical arbor. 1.2 Calculated RPM (cutting speed), feed rate and depth of cut as per job requirement. 1.3 Checked machine performance in conformance to the job requirement. 1.4 Applied coolant to prevent over heating of work piece and cutting tool. 1.5 Performed plain milling operation using cylindrical plain milling cutter and using conventional milling methods to produced flat surface on job in which the cutter axis and job axis are parallel. 1.6 Performed side-milling operation using side milling/end milling cutter and to produce flat surface, slots, grooves or finishing the edges of the work pieces. 1.7 Carried out face milling operation to producing a flat surface, which is perpendicular to the axis of the rotating face milling cutter. 1.8 Checked/measured job in conformance to specification using appropriate techniques, measuring tools and equipment.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **PERFORM SLOT, PARTING OFF, END AND ANGULAR MILLING OPERATION**	**Nominal Duration:** 60 hrs.	**Unit Code:** SEIP-LIG-MIL-6-O
Unit Descriptor: This unit covers the knowledge, skill and attitude required of a worker to perform slot, part off, end and angular milling operation. It specifically includes the tasks of determining job requirement, performing slot-milling operation, performing parting off milling operation, performing end-milling operation, performing angular milling operation and cleaning and storing tools and equipment.		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Determine job requirement	1.1 Drawings and specifications are interpreted pertaining to slot, saw, end and angular milling operation 1.2 Milling accessories and attachment are used appropriate to the requirements of the operation. 1.3 Sequence of operation is determined to produce milling works according to specifications. 1.4 Required **material** is selected according to job requirements. 1.5 Cutting fluid is selected according to the instruction of manual. 1.6 **Milling cutters** are selected according to the requirements of the job and the operation. 1.7 **PPE** is selected and used. 1.8 Safe work practices are observed and personal protective equipment (PPE) are worn as required of the work to be performed
2. Perform slot milling operation	2.1 The horizontal/vertical machine with a vise on the table and end milling cutter on the horizontal/vertical arbor or adaptor is set up in accordance with workplace requirements 2.2 RPM, cutting speed, feed rate and depth of cut are calculated as per job requirement. 2.3 Machine performance is checked in conformance to the job requirement. 2.4 Coolant is applied to prevent over heating of work piece and cutting tool 2.5 Slot milling operation is performed by an end milling cutter and produced slot, key way slot, & T-slot on the job in which the cutter axis and job axis are parallel. 2.6 Job is checked/measured for conformance to specification using appropriate techniques, measuring tools, and equipment.
3. Perform parting off milling operation	3.1 The horizontal/vertical machine with a vise on the table and a slitting saw milling cutter set on the horizontal/vertical arbor is set up according to job requirement. 3.2 RPM, cutting speed, feed rate and depth of cut are calculated as per job requirement. 3.3 Machine performance is checked conforming to the job requirement. 3.4 Coolant is applied to prevent over heating of work piece and cutting tool. 3.5 Part off milling operation is performed using slitting/part off milling cutter to separate stock/work piece. 3.6 Job is checked/measured for conformance to specification using appropriate techniques, measuring tools and equipment.

4. Perform end milling operation	4.1 The horizontal/vertical machine with a vise on the table and an end milling cutter set on the horizontal/vertical arbor is set up according to job requirement 4.2 RPM, cutting speed, feed rate and depth of cut are identified as per job requirement. 4.3 Machine performance is checked conforming to the job requirement. 4.4 Coolant is applied to prevent over heating of work piece and cutting tool. 4.5 End milling operation is performed both axial and radial entering into the work piece and makes either peripheral slot cuts, profile, slot pocket or complex surface contour cut by an end mill cutter. 4.6 Job is checked/measured for conformance to specification using appropriate techniques, measuring tools, tools and equipment.
5. Performing angular milling operation	5.1 The horizontal/vertical machine with a vise on the table and an angular milling cutter set on the horizontal arbor is set up according to job requirement 5.2 RPM, cutting speed, feed rate and depth of cut are calculated as per job requirement. 5.3 Machine performance is checked conforming to the job requirement. 5.4 Coolant is applied to prevent over heating of work piece and cutting tool. 5.5 Angular milling operation is performed to produce all **types of angular cuts**. 5.6 Job is checked/measured for conformance to specification using appropriate measuring tools and equipment
6. Clean and store tools and equipment	6.1 **Tools, equipment** and milling machine are cleaned. 6.2 Work place is cleaned 6.3 Waste materials are disposed in proper place. 6.4 Tools, equipment and finished product are stored safely in appropriate location according to standard place and procedures.

Range of Variables

Variable	**Range** May include but not limited to:
1. Materials	1.1 Mild steel 1.2 Medium carbon steel 1.3 Cast iron 1.4 Brass 1.5 Aluminum 1.6 Gun metal 1.7 Bronze
2. Milling cutter	2.1 Side milling cutter 2.2 Slitting saw milling cutter 2.3 Double angle milling cutter 2.4 Single angle milling cutter 2.5 End milling cutter
3. PPE	3.1 Dust musk. 3.2 Machine goggles. 3.3 Safety shoes. 3.4 Apron
4. Types of angular cuts.	4.1 V-notches

	4.2 Grooves, 4.3 Serrations 4.4 Angular surfaces
5. Tools & equipment.	5.1 Tools 5.1.1 Vise handle. 5.1.2 Parallel bar. 5.1.3 Soft hammer. 5.1.4 Wrenches. 5.2 Equipment 5.2.1 Machine vise. 5.2.2 Universal vise. 5.2.3 Collect chuck. 5.2.4 Adaptor. 5.2.5 Short and long arbor. 5.2.6 Drawbar. 5.2.7 Vertical milling attachment.

Curricular Content Guide

1. Underpinning Knowledge	1.1 Procedure in setting up the horizontal/vertical milling machine 1.2 Installation procedure for cylindrical plain, side milling/end milling, face milling cutter on the horizontal/vertical arbor on a vise 1.3 Methods of Calculated RPM, cutting speed, feed rate and depth of cut as per job requirement. 1.4 Machine performance checks to conform to the job requirement. 1.5 Function of coolant on milling operation 1.6 Procedure on slot milling operation 1.7 Types of cutters used in slot milling 1.8 Procedure in parting off milling operation 1.9 Types of cutting tools used for parting off milling operations 1.10 Procedure in Performing axial and radial end milling operation 1.11 Types of milling cutters used in axial and radial milling operations 1.12 Procedure in Performing angular milling operation 1.13 Types of milling cutters used in angular milling operation 1.14 Methods of checking/measuring of work pieces 1.15 Tools and measuring equipment used in checking and measuring work pieces
2. Underpinning Skills	2.1 Setting up the horizontal/vertical milling machine 2.2 Calculating and applying RPM, cutting speed, feed rate and depth of cut as per job requirement. 2.3 Checking machine performance to conform with the job requirement. 2.4 Applying coolant to prevent over heating of work piece and cutting tool. 2.5 Performing slot milling operation using an end milling cutter 2.6 Performing parting off milling operation using slitting/parting off milling cutter 2.7 Performing axial and radial end milling operation on work pieces 2.8 Performing angular milling operation 2.9 Checking/measuring work pieces in accordance with job specification

3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace 3.3 Promptness in carrying out activities 3.4 Tidiness and timeliness 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern 3.7 Sincere and honest to duties
4. Resource Implications	The following resources MUST be provided: 4.1 Workplace. 4.2 Tools, equipment and facilities appropriate to processes or activity. 4.3 Materials relevant to the proposed activity. 4.4 Equipment and outfits appropriate in applying safety measures. 4.5 Relevant drawings, manuals, codes, standards and reference material.

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate: 1. Set up the horizontal/vertical milling machine with a vise on the table and a cylindrical plain, side milling/end milling, face-milling cutter on the horizontal/vertical arbor. 2. Calculated and applied RPM, cutting speed, feed rate and depth of cut as per job requirement. 3. Checked machine performance to conform to the job requirement. 4. Applied coolant to prevent over heating of work piece and cutting tool. 5. Performed slot milling operation using an end milling cutter and produced slot, key way slot, & T-slot on the job where the cutter axis and job axis are in parallel 6. Performed parting off milling operation using slitting/parting off milling cutter to separate stock/work pieces. 7. Performed axial and radial end milling operation on work pieces making either peripheral slot cuts, profile, slot pocket or complex surface contour cut using an end mill cutter. 8. Performed angular milling operation producing all types of angular cuts on surfaces using angular cutters. 9. Checked/measured job in conformance with specification using appropriate techniques, measuring tools and equipment.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

Unit of Competency: **PERFORM GEAR CUTTING OPERATION ON MILLING MACHINES**	**Nominal Duration:** 50 hrs.	**Unit Code:** SEIP-LIG-MIL-7-O
Unit Descriptor: This unit covers the knowledge, skill and attitude required of a worker to perform gear cutting operation on milling machines. It specifically includes the tasks of determining job requirement, performing gear cutting and cleaning and storing the tools and equipment**.**		

Elements and Performance Criteria:
(Terms in the performance criteria that are written in **bold and underlined** are elaborated in the range of variables).

Elements of Competency	Performance Criteria
1. Determine job requirement	1.1 Drawings are interpreted to cut **different types of gear** according to the drawing and specifications. 1.2 Milling index head and indexing methods are used as appropriate to the requirements of the different types gear cutting. 1.3 Different Gear blanks and mandrills are made as per requirement. 1.4 **Gear teeth nomenclature** and formulas are calculated for the different types of gear**.** 1.5 Sequence of operation is determined to produce job according to specifications. 1.6 Required **material** is selected according to job requirements. 1.7 **Gear form cutters set** and **pressure angles** are selected according to the requirements of the job and the specifications. 1.8 Safe work practices observed and personal proactive equipment (**PPE**) worn as required for the work performed
2. Perform gear cutting	2.1 The horizontal/vertical machine with index head on the table and set gear cutter on the horizontal/vertical arbor as per requirement is set up according to the job requirement 2.2 RPM, cutting speed, feed and depth of cut are calculated as per job requirement. 2.3 Machine performance is checked conforming to the job requirement and coolant is applied to prevent over heating of work piece and cutting tool. 2.4 Different gear cutting is performed as per the job requirement. 2.5 Job is checked/measured for conformance to specification using appropriate techniques, **measuring tools,** and equipment.
3. Clean and store the tools and equipment	3.1 **Tools, equipment** and **milling machine** are cleaned. 3.2 Work place is cleaned. 3.3 Waste materials are disposed in proper place. 3.4 Tools, equipment and finished job are stored safely in appropriate location according to standard place and procedures.

Range of Variables

Variable	Range May include but not limited to:
1. Different types of gear.	1.1 Spur gear 1.2 Helical or serial gear 1.3 Bevel gear 1.4 Worm and worm gear

	1.5 Rack and pinion	
2. Gear teeth nomenclature.	2.1 Addendum 2.2 Dedendum 2.3 Pressure angle 2.4 Addendum circle 2.5 Dedendum circle 2.6 Circular pitch 2.7 Tooth thickness 2.8 Pitch diameter 2.9 Working depth 2.10 Whole depth 2.11 Addendum angle 2.12 Dedendum angle 2.13 Center distance 2.14 Top land 2.15 Face width	2.16 Face 2.17 Flank 2.18 Bottom land 2.19 Clearance 2.20 Clearance circle 2.21 Fillet radios. 2.22 Diametral pitch 2.23 Module 2.24 Outside diameter 2.25 Root diameter 2.26 Nominal diameter 2.27 Base diameter 2.28 Line of action 2.29 Involute and cycloid curve
3. Materials	3.1 Mild steel 3.2 Medium carbon steel 3.3 Cast iron 3.4 Brass 3.5 Aluminum 3.6 Gun metal 3.7 Bronze	
4. Gear form cutters set	4.1 The set of eight cutters and their necessary No. of teeth cutting ability 4.1.1 No. 1 will cut wheel from 135 teeth to a rack 4.1.2 No. 2 will cut wheel from 55 teeth to a 134 teeth 4.1.3 No. 3 will cut wheel from 35 teeth to a 54 teeth 4.1.4 No. 4 will cut wheel from 26 teeth to a 34 teeth 4.1.5 No. 5 will cut wheel from 21 teeth to a 26 teeth 4.1.6 No. 6 will cut wheel from 17 teeth to a 20 teeth 4.1.7 No. 7 will cut wheel from 14 teeth to a 16 teeth 4.1.8 No. 8 will cut wheel from 12 teeth to a 13 teeth	
5. Pressure angle	5.1 -14.5 degrees pressure angle 5.2 - 20 degrees pressure angle	
6. PPE	6.1 Dust mask 6.2 Machine goggles 6.3 Safety shoes 6.4 Apron	
7. Measuring tools	7.1 Steel rule 7.2 Vernier caliper 7.3 Gear teeth Vernier caliper 7.4 Dial indicator	
8. Tools & equipment.	8.1 Tools 8.1.1 Vise handle 8.1.2 Parallel bar 8.1.3 Soft hammer 8.1.4 Wrenches 8.2 Equipment 8.2.1 Machine vise 8.2.2 Universal vise 8.2.3 Index head 8.2.4 Tailstock 8.2.5 Milling jacks 8.2.6 Short and long arbor	

	8.2.7 Drawbar 8.2.8 Vertical milling attachment
9. Milling machine	9.1 Vertical milling machine 9.2 Horizontal milling machine 9.3 Universal milling machine

Curricular Content Guide

1. Underpinning Knowledge	1.1 Drawings interpretation procedures as per different types of gear 1.2 Functions of milling index head 1.3 indexing methods and procedure 1.4 Procedure of making gear blanks and mandrills 1.5 Gears teeth nomenclature and formulas 1.6 Sequence of operation in gear making 1.7 Materials used for gear making 1.8 Gear form cutters set and pressure angles selection methods 1.9 Safety when performing gear cutting operations
2. Underpinning Skills	2.1 Setting up the horizontal/vertical machine with index head on the table and set gear cutter on the horizontal/vertical arbor as per requirement. 2.2 Calculating RPM, cutting speed, feed rate and depth of cut as per job requirement. 2.3 Checking machine performance in conformance to job requirement 2.4 Applying coolant to prevent over heating of work piece and cutting tool. 2.5 Performing different gear cutting operations as per job requirement. 2.6 Checking/measuring work piece in conformance to specification using appropriate techniques, measuring tools, and equipment.
3. Underpinning Attitudes	3.1 Commitment to occupational health and safety practices 3.2 Communication with peers, sub-ordinates and seniors in workplace. 3.3 Promptness in carrying out activities. 3.4 Tidiness and timeliness. 3.5 Respect of peers, sub-ordinates and seniors in workplace. 3.6 Environmental concern. 3.7 Sincere and honest to duties.
4. Resource Implications	4.1 Workplace 4.2 Tools, equipment and facilities appropriate to processes or activity. 4.3 Materials relevant to the proposed activity. 4.4 Equipment and outfits appropriate in applying safety measures. 4.5 Relevant drawings, manuals, codes, standards and reference material.

Assessment Evidence Guide

1. Critical Aspects of Competency	Assessment required evidence that the candidate:

	1.1 Set up the horizontal/vertical machine with index head on the table and set gear cutter on the horizontal/vertical arbor as per requirement. 1.2 Calculated RPM, cutting speed, feed rate and depth of cut as per job requirement. 1.3 Checked machine performance in conformance to job requirement 1.4 Applied coolant to prevent over heating of work piece and cutting tool. 1.5 Performed different gear cutting operations as per job requirement. 1.6 Checked/measured work piece in conformance to specification using appropriate techniques, measuring tools, and equipment.
2. Methods of Assessment	Competency should be assessed by: 2.1 Written examination 2.2 Demonstration 2.3 Oral questioning 2.4 Workplace observation 2.5 Portfolio
3. Context of Assessment	3.1 Competency assessment must be finished in a training center or in an actual or simulated work place after completion of the training module.

End of Competency Standard

Assessment Guide

A Framework for Effective Assessment

Milling Machine Operation

How to Use this Assessment Guide

- This Assessment Guide presents need-to-know information for Assessors and others who want to know more about the assessment process. A handy Table of Contents Guide on the next page shows you where to look.

- If you want the basics of assessment, its key terms and definitions, in a Question & Answer (Q&A) format, see Section One.

- If you want a knowledge of who does what, the key roles and responsibilities involved in assessment, see Section Two.

- If you want a “toolbox” of tools and templates, that you can select from depending on your assessment need, see Section Three.

- If you want to look at working samples of completed assessment tools, see the Appendices.

Table of Contents

Section One: Q&A linked to Key Terms & Definitions

1.25 Define the term “evidence gathering tools” giving examples
1.26 Define the term “portfolio.”
1.27 Outline a 6-step method for preparing an evidence plan.

1.28 Outline the steps (sequence of activities) involved in developing an assessment tool.
1.29 Describe the four dimensions of competency.

Section Two: Roles and Responsibilities

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Assessment Guide

Section One: Objectives linked to Key Terms & Definitions

Define assessment.

Assessment is a systematic process of collecting proof or evidence on whether or not a candidate has demonstrated competence in the performance of a work-related activity/task that is directly linked to a performance standard. The assessment confirms that the individual can perform to the standard expected in the workplace and/or the nationally approved competency standard.

Give an example of assessment.

A helpful example in this regard is the driving test. The driver must prove his competence to drive by demonstrating to the driving assessor his ability to do so. The driving assessor uses a checklist to assess the candidate and make the necessary recommendations, based on the evidence he has collected in observing the candidate's driving. S/He either records/recommends that the candidate is ***competent*** or ***not yet competent.***

What is the purpose of assessment?

The Purpose of Assessment is to confirm that a trainee can perform competently to the standards expected in the workplace.

What is Assessment based on?

- An effective Assessment is based on a Competency Standard.
- A Competency Standard describes the skills, knowledge, and attitudes needed to perform effectively in the workplace, not the classroom.

Define the term "competency."

Competency is the ability to do a task successfully. Aspects of competency include:

- The capacity to perform tasks to the required standard consistently
- The ability to respond to different needs in the workplace
- The ability to plan and integrate a variety of tasks to attain a work outcome

Describe what makes up a competency standard.

It must be noted that a competency standard is made up of individual units of competency that include elements of competency as well as the performance criteria needed to accomplish them.

Define the term "Assessment tool."

An assessment tool is, in effect, an evidence-gathering tool. It contains both the instrument used for the assessment and instructions for gathering evidence in the assessment process. As an assessment instrument it contains the context and conditions for the assessment; tasks to be administered to the learner; an outline of the evidence to be gathered for the learner; the criteria for judging the evidence; and the necessary housekeeping records for recording and reporting requirements.

Describe the difference between Conventional Testing & Competency Based Assessment.

Conventional Testing	CBT Assessment
• Emphasis on knowledge/memorization • Teachers/Training Providers have main role • Theory & practical Tests can become outdated • High cost & central control • Relatively inflexible	• Based on competency standards • Involve industry partners in crucial role • Assessment based on demonstration of work skills rather than classroom knowledge • Flexible delivery • Competencies widely recognized • Guidelines & Templates used

Describe briefly what makes up an assessment system.

An Assessment System must be understood as a well-coordinated set of documented policies and procedures, including assessment materials and tools, that ensure assessments are consistently valid, reliable, flexible, fair, and safe.

Define the purpose of the Assessor role.

The role of Assessor is the heart and soul of effective competency based assessment. Without this pivotal role, determining the competency of the trainee is mere guesswork.

Note:

- The Industry Assessor will be asked to provide specs and practical demonstration tests from his workplace that will provide the evidence for determining competency.
- The importance of this input cannot be overemphasized for it best matches and tests the required performance criteria from the Standard.

Describe the basic questions that an Assessor must ask when planning an Assessment.

Planning an Assessment: What Needs to Happen?

- Determine which Units of Competency need to be assessed?
- Determine what Assessment Methods will be used?
- Determine what evidence-based tools (specs) need to be developed by the Assessor to guide the assessment?
- Determine how long it will take?
- Determine when the assessment will occur?
- Determine where the assessment will take place?
- Determine how it will be recorded?

Give some Assessor Requirements/Competencies.

Requirements/Competencies of an Assessor-

- The ability to use assessment tools to gather evidence effectively is essential, adjusting the language where necessary to reflect the language/literacy/numeracy levels of the workplace and not to exceed them in order to ensure learner understanding. This will also entail an ability to respond to learner needs such as responding to learner disability.

- The skill to develop specifications and practical tests, based on performance criteria, that provide evidence of competency that will fast track the assessment process.
- The ability to clearly demonstrate current industry skills and competencies relevant to the Standard.

- The Assessor is selected/appointed by Industry to act as an Assessor because of his proven competencies.
- Knows what needs to be done to assess the performance criteria
- Demonstrates a high level of expertise in the technical area to be examined
- Can provide constructive feedback

Define the challenges of the Assessor Role.

Assessor Role: Challenges

- Needs to be objective and unbiased
- Must have interpersonal skills to relax nervous candidates or deal with those who are aggressive or emotional
- Must have ability to deal with those who have literacy problems or difficult dialect

Review some basic need-to-know elements concerning assessment.

Assessment Basics: Need to Know Elements

- Assessment to be conducted by Industry Assessor selected by industry
- Industry assessor must be familiar with units of competency outlined in the course standards
- Industry Assessor should drafts specs that reflect industry requirements for trainees and that are based on critical aspects of competency
- Industry assessor is responsible for making final judgment of **competent** or **not yet competent**
- Trainer will assist industry assessor

- Trainees must demonstrate competence based on the units of competency outlined in the standards
- All resources related to units of competency must be made available prior to the assessment event, e.g., tools, equipment, materials

Describe the trainer's role in the assessment process.

The Trainer acts as a primary resource for the Assessor and acts as a Facilitator.

Trainer ensures:

- All industry required tools, equipment, and materials are available for the assessment
- The training venue is booked and has sufficient space for demonstrations/tasks
- That all logistics such as admission slips, signature sheets, and records are readily available for distribution and collection
- That all teaching materials and Standard documents and Assessment tools are ready for the Assessor

Discuss the importance of principles of assessment and what is involved.

Principles of Assessment Table

Key Principles	Relevance/Meaning
Valid	Ensures assessment aligned with the Unit of Competency and is based on evidence that shows the learner can demonstrate skills and knowledge in other similar contexts (workplace)
Reliable	Evidence presented for assessment is consistently interpreted regardless of the Assessor
Flexible	Assesses competencies held by the learner regardless of where they have been acquired; reflects the individual learner's needs
Fair	The individual learner's needs or disability is considered in the assessment process; the learner is provided with information about the assessment process and given the opportunity to challenge the result of the assessment if warranted
Safe	The assessor has inspected the venue for assessment and determined that it is safe for all involved and that emergency evacuations are in place if needed

Define the term "evidence."

Evidence is information that is gathered and matched against a Unit of Competency to provide proof of competency.

State the different forms of evidence that can be collected.

Different forms of evidence that can be collected are-

- **Direct** such as demonstration test, or observation of Candidate
- **Indirect** such as Candidate's self-assessment or third party reports such as an employer interview

Describe and outline what is involved in "rules of evidence" and why they are important.

Rules of Evidence Table

Rules of Evidence	Meaning
Valid	The assessor is given assurance that the learner possesses the skills, knowledge, and attitudes described in the Unit of Competency and related assessment requirements
Sufficient	The assessor is assured that the quality, quantity, and relevance of the evidence is sufficient to enable a judgment to be made on the learner's competency
Authentic	The assessor is assured that the evidence provided for assessment is the learner's own work
Current	The assessor is assured that the assessment evidence demonstrates current competency of the learner. This evidence must be from the present or very recent past.

Describe the purpose of evidence gathering tools.

The Purpose of evidence gathering tools are-

- To help candidates understand what is expected of them
- To provide a focus for the assessment
- To identify what is needed to verify competency

State the use of the evidence guide.

The evidence guide provides useful advice on Unit of Competency assessment and must be read in conjunction with the performance criteria, required underpinning skills/knowledge/attitudes, range statement, and the critical aspects of competency for the Standard.

State why assessment evidence is important.

Evidence is the information gathered that provides proof that the performance criteria of a unit of competency has been met. Evidence can take many forms:

- **Observation:** watching the trainee perform
- **Questioning:** asking the trainee questions
- **Demonstration of specific skills:** seeing how the trainee performs a procedure or creates a final product
- **Examining** previous work the trainee has done

Describe the kinds of Assessment Methods that can be used for Evidence gathering purposes.

Various kinds of Assessment Methods can be used for Evidence gathering purposes. A wide range of assessment methods are available for Evidence- gathering purposes. Assessment methods are not limited to those listed below. The greater the range of assessment methods applied, the better the accuracy of the assessment.

Assessment Methods Table

Methods	Examples

Direct Observation of Candidate	Actual real-time activities in the workplace Work activities in a simulated workplace/training center
Questioning	Written questions; interviews; self-evaluation with questions; verbal questioning; questionnaires
Evidence compiled by Candidate	Portfolio; collection of work samples; products with supporting documentation; logbooks; information about life experience
Methods	Examples
Review of Product	Work samples and products; products as a result of a demonstration test/spec
Third Party Feedback	Reports/testimonials from Employers and Supervisors; evidence of training; interviews with Employers and Supervisors

Advice to the Assessor: use these methods and examples as a means of making your assessment valid, reliable, flexible, fair, and safe.

Define the term "evidence gathering tools" and give some examples of these tools.

Evidence gathering tools are the actual instruments that the Assessor uses to collect evidence. Evidence may be collected through:

- Demonstration of work activity
- Observation Checklist
- Question List
- Third party reports e.g. supervisor to verify consistent performance
- Review of candidate's portfolio
- Verifying the Candidate's capacity to deal with contingencies (unexpected things that come up)
- Written test

Define the term "portfolio."

A collection of evidence that may be presented by the Candidate to an Assessor to prove the Candidate's competence at a job or task.

What are some examples of Portfolio Evidence?

- Training results and certificates
- Training workbooks
- References from employers
- Job description and work experience
- Photos and videos
- Work journals
- Awards
- Work samples
- Letters and memos

Outline a 6-step method for preparing an evidence plan.

Steps in Preparing an Evidence Plan (Sequence of Steps to Follow)-

The Evidence Plan is the most important planning tool for an Assessor. A good evidence plan generates a list of the evidence that the Assessor must gather when conducting the assessment for a specific Unit of Competency. The following 6-Point Method for preparing an Evidence Plan provides a useful sequence of inter-related steps to follow:

1. Select Unit of Competency for assessment
2. Read full Unit of Competency
3. Identify evidence requirements based on:
    a. Elements and Performance Criteria
    b. Dimensions of Competence
    c. Underpinning skills knowledge
    d. Critical aspects of competency
4. Develop a list of evidence requirements
5. Identify best ways of collecting evidence (tools)
6. Document evidence plan

Outline the steps (sequence of activities) involved in developing an assessment tool.

Following are the steps (sequence of activities) involved in developing an assessment tool:

1. Select the Unit of Competency
2. Read the Unit of Competency
3. Identify the required evidence: critical aspects of competency
4. Identify the evidence gathering method
5. Complete the evidence plan
6. Select the appropriate template
7. Complete the template
8. Check the evidence gathering tools against the evidence plan and Unit of Competency
9. Check the tool with another Assessor for his opinion

Describe the four dimensions of competency.

Task Skills: the capacity to perform tasks in the workplace and demonstrate competence that meets the required Standard;

Task Management Skills: the ability to plan and integrate several tasks simultaneously that achieve a desired work outcome such as those skills involved in budgeting for a work operation, securing supplies and equipment for the work operation, completing the task in a timely, cost-effective manner, and ensuring safety practices are followed throughout;

Contingency Management Skills: the ability to respond to crises and breakdowns in the workplace, such as accidents and emergency situations that are unanticipated and require immediate action and resolution;

Job/Role Environment Skills: the capacity to own the responsibilities and expectations of the work environment that involves working with others effectively and participating in creating a work culture where all can contribute their best within the parameters of their job role

Assessment Guidelines

Section Two: Roles and Responsibilities

The Assessment System: Planning Guide for the Assessor

An Assessment System must be understood as a well-coordinated set of documented policies and procedures, including assessment materials and tools, that ensure assessments are consistently valid, reliable, flexible, fair, and safe.

Competency Assessment is a systematic process of collecting proof or evidence on whether or not a candidate has demonstrated competence in the performance of a work-related activity/task that is directly linked to a performance standard. The assessment confirms that the individual can perform to the standard expected in the workplace and/or the nationally approved competency standard.

Each **Unit of Competency** contained in a Standard describes a distinct part of a Mason's work and job profile. Within each Unit of Competency, the following components appear:

- Unit Title
- Unit Descriptor
- Elements of Competency
- Performance Criteria
- Range of Variables
- Evidence Guide

As a prelude to conducting assessments, the Assessor must be thoroughly familiar with all of the particulars and details of the Unit of Competency that is being assessed. This is a "must" for the role of the Assessor. He must be especially familiar with the Evidence Guide for gathering critical information.

The three sample assessment tools found below focus on the critical aspects of competency that can provide the required evidence to determine competency- the evidence guide. These sample assessment tools are as follows:

- Demonstration Checklist
- Observation Checklist
- Oral Questions Checklist

The duties of the Assessor include:

- Covering all of the key elements of the Unit of Competency under assessment
- Applying rigorously the Evidence Guide for the Unit of Competency as this contains the method and context of assessment, resources required for the assessment, the critical aspects of competency, and the required underpinning knowledge, skills, and attitudes
- Developing specifications (specs) for the task sheet for Demonstration as required
- Requiring the candidate to perform project tasks that cover interrelated units of competency- known as a "clustering."
- Making what can be termed "reasonable adjustments" for candidates with disabilities or for example, those candidates with regional dialects that prove difficult to understand

Note: These "reasonable adjustments" may involve reconfiguring a simulated workplace site so that a candidate's disability does not impede the assessment process, or for example, finding someone who can understand a regional dialect and assist the Assessor with essential communication skills.

Roles and Responsibilities of Assessor

Prior to any assessment, the Assessor should follow the specific instructions below to ensure a well-planned assessment event. In most cases s/he will be assisted by a Trainer. Nevertheless, s/he should make certain that good preparation has taken place for the assessment event.

1. Visit the assessment venue or workplace to ensure an adequate work area or platform containing:

- Sufficient space for working- ensure square meters of work space enough for task to be carried out effectively and safely
- Fire extinguisher and safety equipment within reach
- Emergency procedures in place
- All necessary tools, equipment, and materials ready at hand
- All necessary machinery in good working order

2. Assessment is drawn and extracted from the relevant Unit of Competency based on an approved Standard and on an Evidence plan that clearly focuses on critical aspects of competency.

3. The duration of time to assess the demonstration is clearly indicated, for example, 3 hours. This information is shared with the Candidate along with other pertinent information such

as the sequence of tasks that he must follow, and the fact that he will be closely observed as the tasks are performed.

4. After the Candidate has performed the task, the Assessor will provide feedback to the Candidate on his performance.

5. The responsibility on finally deciding whether or not the Candidate was Competent or Not Yet Competent belongs to the accredited Assessor.

6. At the conclusion of the assessment, the Assessor will provide feedback on whether or not the Candidate was Competent or Not Yet Competent. S/He will also share information on next steps. These next steps include where to obtain the certificate related to the assessment or, if unsuccessful, how to re-try for competency within a specified period of time.

Roles and Responsibilities of Trainer

Prior to the assessment, you will have studied and become familiar with the Competency Standard for the industry occupation. You will also have met with or contacted the Assessor beforehand and discussed preparations and arrangements for the assessment. Your role will be to facilitate the assessment process and ensure all necessary resources are available, assisting the Assessor wherever possible. For example, once a draft spec has been produced by the Assessor, you will ensure it is fully consistent with the evidence plan and copied appropriately for use by both the Assessor and Candidate.

In addition to a confirming a suitable training venue and time, you will ensure that:

- Sufficient space is allotted for task work- square meters of work space enough for demonstration tasks to be carried out effectively and safely
- Fire extinguisher and safety equipment within reach if necessary
- Emergency procedures in place
- All necessary tools, equipment, and materials ready at hand
- All necessary machinery in good working order

Your duties include:

- **notifying** the Assessor and candidates of planned assessment events and their location
- **advising and assisting** the Assessor on planned assessment events
- **collecting** admission slips and signature sheets for assessment events
- **ensuring** all required forms and reporting mechanisms are in place and ready for distribution to the Assessor and to the Candidate
- **ensuring** all requisite forms are duly signed and forwarded to the SEIP Office, or certifying body

- **responding** to candidate queries and concerns such as re-assessment procedures
- **reconfiguring** workplace simulations so that candidates with disabilities are able to participate fully and without impediment
- **working** closely with the SEIP contact to ensure a successful assessment event

Roles and Responsibilities of Candidate

Prior to the assessment, you will have studied and become familiar with the Competency Standard for your industry.

1. Initially, you will be given information on the task you are to perform, and the estimated time you will require to perform it. These tasks are based on the critical aspects of competency related to the performance criteria within the approved Competency Standard.

Given the necessary instructions, and/or a task-related spec and the necessary tools, materials, and equipment, you will carry out and complete a work task. You will observe that there is:

- Sufficient space for working- square meters of work space enough for task to be carried out effectively and safely
- Fire extinguisher and safety equipment within reach if necessary
- Emergency procedures in place
- All necessary tools, equipment, and materials ready at hand
- All necessary machinery in good working order

2. Assessment is drawn and extracted from the relevant Unit of Competency based on the approved Competency Standard and on an Evidence plan (proof of competence) developed by the Assessor that clearly focuses on critical aspects of competency. The Evidence plan will be based on critical assessment tools such as demonstration/task; observation; oral questions.

3. The duration of time to assess the demonstration should be clearly indicated, for example, 3 hours. This information will be given to you along with other pertinent information such as the procedure or sequence of tasks that you must follow. It is important to note that you will be closely observed and assessed throughout the duration of your demonstration. You will be given time to ask questions and request clarification. You will also be given 10 minutes to familiarize yourself with the resources to be used in the assessment.

4. Based on your performance in demonstrating the task, you will be assessed by the Assessor to be Competent or Not Yet Competent. Regardless of the result you will be given feedback from the Assessor on your performance and the next steps.

5. After you have performed the task, the Assessor will provide feedback to you on your performance.

6. The responsibility on finally deciding whether or not you are Competent or Not Yet Competent belongs to the accredited Assessor.

7. At the conclusion of the assessment, the Assessor will provide feedback on whether or not you have been assessed to be **Competent** or **Not Yet Competent**. Both your signatures will be required on the Assessment Form. You will also be allowed to make comments on the Assessor's decision. The Assessor will then share information on next steps. These next steps include where to obtain the certificate related to the successful assessment or, if unsuccessful, how to re-try for competency within a specified period of time.

Section Three: Tools and Templates

This toolbox of Tools and Templates offers a wide range of assessment tools that will facilitate evidence gathering and other assessment-related needs. Evidence gathering, however, should not be limited to these tools and templates alone. The toolbox should be revised or expanded as necessary, to include other tools and templates that are deemed relevant.

- Demonstration Checklist
- Observation Checklist
- Oral Questions Checklist
- Evidence Plan (Overall Summary)
- Assessor Job Sheet and Specifications (Spec) Form
- Competency Assessment Results
- Assessor Planning Checklist Tool
- All About Questioning Techniques for Use in Assessment
- Quick Guide to Conducting Competency Assessments
- Assessor's Quick Start

Demonstration Checklist

Candidate's name:	
Assessor's name:	
Qualification:	
Project-Based Assessment Title	
Units of competency covered:	
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐
•	☐	☐	☐

Observation Checklist

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:			
Code:			
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist

Candidate's name:	
Assessor's name	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	
Reference Standard:	

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for competent/non yet competent.

List of Questions	Satisfactory Response	
Indicate Y or N in the box provided	YES	NO
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		

Feedback to Candidate:

Candidate's overall performance was (circle):	Satisfactory	Not Satisfactory
The Candidate's underpinning knowledge was (circle):	Satisfactory	Not Satisfactory

Assessor Signature:	Date:
Candidate Signature:	Date:

EVIDENCE PLAN: Overall Summary

QUALIFICATION:	
Project-Based Assessment Title	
Units of competency covered	

Ways in which evidence will be collected: [tick the column] The evidence must show that the candidate …..	Observation with Questioning	Demonstration with Questioning	Written Examination	Portfolio
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				
•				

Assessor Job Sheet and Specifications (Spec) Form

This Spec is in reference to the_____ Standard, and has been developed by an Industry Representative/Assessor.

The Result* indicates either C for Competent, or NYC for Not Yet Competent.

Unit of Competency	Elements Reviewed	Critical Aspects of Competency Covered	Result*: C/NYC

JOB #1 Procedure for Developing Specification (Spec): List the steps involved in performing the task/spec successfully. It will cover, in logical order, the critical aspects of competency listed above that will determine if the candidate is **Competent** or **Not Yet Competent.**

1.	
2.	
3.	
4.	
5.	

Tools and Equipment Required for Spec completion: List all tools, equipment, and materials required in completing Job #1:

Tools	Equipment	Materials

Assessor Name: Date:

Competency Assessment Results

Candidate's name:	
Assessor's name	
Qualification Title:	
Date of Assessment:	
Assessment Venue:	
Reference Standard:	
Unit of Competency:	

Assessment Unit	Competent	Not Yet Competent

Assessor's Recommendation and Comments:

Overall Assessment:

Yes: The Candidate successfully met the required evidence/standards and demonstrated all of the competencies necessary for certification in the Qualification and Units of Competency listed above.

No: The Candidate did not meet the evidence requirements. Re-assessment is recommended.

Assessor Signature:	Date:
Candidate Signature:	Date:
Assessment Center Manager Signature:	

ASSESSMENT PLANNING CHECKLIST TOOL

Assessor's name:	
Date:	

Directions: Circle the 'Yes' or 'No' response to each item.

1.	The Assessor is familiar with the unit(s) of competency being assessed	Yes	No
2.	The Assessor has verified that the workplace or training center has the correct equipment, machinery, tools, and materials necessary to complete all of the relevant aspects of the unit of competency	Yes	No
3.	The Assessor has ensured that all materials and equipment were assembled and arranged in advance.	Yes	No
4.	The Assessor has all the necessary tools, templates, and specifications needed to assess the trainee including a variety of assessment tools covering practical demonstration, observation, oral question, and (where necessary) written tests relevant to the competency specified in the standard	Yes	No
5.	The Assessor has met with the trainer prior to the assessment event to discuss his/her role.	Yes	No
6.	The Assessor will discuss the performance test with the trainee and address any concerns prior to giving the test	Yes	No
7.	The Assessor will discuss and record with the trainee the results of their performance	Yes	No

Action to be taken on "No" responses:

General Guidelines for Effective Questioning

- Keep questions short and focused on one key concept
- Ensure that questions are structured
- Test the questions to check that they are not ambiguous
- Use `open-ended questions such as `what if...?' and `why...?' questions, rather than closed questions
- Keep questions clear and straight forward and ask one at a time
- Use words that the candidate is able to understand
- Look at the candidate when asking questions
- Check to ensure that the candidate fully understands the questions
- Ask the candidate to clarify or re-phrase their answer if the assessor does not understand the initial response
- Confirm the candidate's response by repeating the answer back in his/her own words
- Encourage a conversational approach with the candidate when appropriate, to put him or her at ease
- Use questions or statements as prompts for keeping focused on the purpose of the questions and the kind of evidence being collected
- Use language at a suitable level for the candidate
- Listen carefully to the answers for opportunities to find unexpected evidence
- Follow up responses with further questions, if useful, to draw out more evidence or to make links between knowledge areas
- Compile a list of acceptable responses to ensure reliability of assessments

Recording responses

When using oral questioning, you may need a tool that has a structured approach (see below) and also enables you to record a candidate's responses. If the candidate's response is insufficient the assessor should record why on the recording sheet or checklist. This provides information that can be used later, if necessary, to explain to the candidate where he or she needs to develop their skills and/or knowledge to achieve the required competence.

Recording sheet for oral questioning (template)

Candidate's Name		
Assessor or Observer's Name		
Unit of Competency)		
Code		
Date of Assessment		
Location		
Task/Procedure		
Questions to be Answered by candidate	Response/Answer*	Satisfactory (Yes/No)
What would you do if …		
What would you do if …		
What would you do if …		
How do you …		
What are …		
Why did you… (Clarification)		
Follow up Questions		
The candidate's knowledge was:	Satisfactory Unsatisfactory	
Feedback to candidate:		
Candidate signature:	Date:	
Assessor/Observer's Signature:	Date:	

ASSESSOR GUIDE TO CONDUCTING COMPETENCY ASSESSMENTS

1. BEFORE THE ASSESSMENT	2. DAY OF ASSESSMENT	3. DURING THE ASSESSMENT	4. POST ASSESSMENT

- Review unit(s) of competency to be assessed especially evidence to be collected against performance criteria - Ensure the workplace or training center complies with all safety requirements and that high risk areas are clearly marked - Identify/request essential assessment resources: • tools and equipment • supplies and materials • personal protective equipment • print resources and rating sheets • Have trainees contacted if they have to bring any resources for the assessment, e.g. logbook	-Verify attendance through signed attendance sheet - Provide overview of what is to happen throughout day Orient the trainees to: • purpose of assessment • qualification to be assessed • assessment procedures to be followed • address needs of trainees and provide information on evidence requirements and assessment process • make all announcements just before start of assessment	Give clear instructions to trainees on what they are required to do: • time limits and expectations • all equipment and tools must be of the same quality for all trainees • written and verbal instructions translated into local dialects as needed • encourage questions • avoid providing any assistance to trainees during assessment • stop process if accident imminent • keep focused on evidence being valid, reliable, fair, flexible, and safe • Record details of evidence collected	Provide feedback on outcome of assessment process re: • give clear feedback on assessment decision • provide information on overcoming any gaps in competency assessment • provide opportunity to discuss assessment process and outcome **Prepare required assessment reports:** • all rating sheets signed by trainee as well as Assessor • maintain records of assessment procedures, evidence collected, and assessment outcome • verify assessment results/outcomes with training center **Prepare** recommendations for issuance of national certificate

Assessor's Quick Start

1. Identify the Unit(s) of Competency from the Program Standard that you are going to assess.

2. Review the Critical Aspects of Competency from the Unit of Competency that will be the basis of your Evidence Guide.

3. Select the Assessment Tools that you will use to gather evidence.
    i. Demonstration Checklist
    ii. Observation Checklist
    iii. Oral Questions Checklist

4. Create spec sheet(s) for the Unit of Competency to be examined.

5. Review the assessment procedure with the Candidate and ask if there are any questions.

6. Complete the assessment using the assessment tools in the order above. You are free to use other tools as well if you wish.

7. Determine whether Candidate is **Competent** or **Not-Yet-Competent**

8. Complete all necessary record sheets.

9. Give feedback to the Candidate.

Demonstration Checklist: Perform Bench Working Operations

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Perform Bench Working Operations (SEIP-LIG-MIL-1-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Clamp work pieces using appropriate work holding devices to avoid damage and accidents	☐	☐	☐
2. Cut, chip, and file work pieces in accord with drawing specs	☐	☐	☐
3. Check measurement of work piece in accord with standard working procedure	☐	☐	☐
4. Perform drilling of holes and reaming following recommended sequence	☐	☐	☐
5. Cut threads and check thread using thread pitch gauge	☐	☐	☐
6. Perform off-hand grinding operation in accord with workplace procedures	☐	☐	☐
7. Perform welding operations	☐	☐	☐
8. Perform heat-treatment process	☐	☐	☐
	☐	☐	☐

Observation Checklist: Perform Bench Working Operations

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Perform Bench Working Operations		
Code:	SEIP-LIG-MIL-1-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Clamp work pieces using appropriate work holding devices to avoid damage and accidents			
2. Cut, chip, and file work pieces in accord with drawing specs			
3. Check measurement of work piece in accord with standard working procedure			
4. Perform drilling of holes and reaming following recommended sequence			
5. Cut threads and check thread using thread pitch gauge			
6. Perform off-hand grinding operation in accord with workplace procedures			
7. Perform welding operations			
8. Perform heat-treatment process			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Perform Bench Working Operations

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Bench Working Operations
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What tool is used for thread cutting work?		
2. Why is it important to clean and store tools properly?		
3. To what extent is safety an important consideration in performing bench work?		
4. What tools and equipment are required for basic welding operations?		
5. Why are heat treatment processes essential?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Carry Out Grinding of Cutting Tools

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Carry Out Grinding of Cutting Tools (SEIP-LIG-MIL-2-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Select and inspect grinding wheels and dress in accord with worksite procedures	☐	☐	☐
2. Adjust grinding machine in accord with work site procedures	☐	☐	☐
3. Hold tool blank and clamp securely to avoid damage	☐	☐	☐
4. Perform grinding of tool blank in accord with specified profile angles of milling cutter	☐	☐	☐
5. Perform drill bit grinding in accord with type of work material to be worked upon	☐	☐	☐
6. Collect milling cutter, drill bits and holding devices as per requirements	☐	☐	☐
7. Use coolant to reduce heat of drill and to prevent material damage and weakening	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Observation Checklist: Carry Out Grinding of Cutting Tools

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Carry Out Grinding of Cutting Tools		
Code:	SEIP-LIG-MIL-2-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Select and inspect grinding wheels and dress in accord with worksite procedures			
2. Adjust grinding machine in accord with work site procedures			
3. Hold tool blank and clamp securely to avoid damage			
4. Perform grinding of tool blank in accord with specified profile angles of milling cutter			
5. Perform drill bit grinding in accord with type of work material to be worked upon			
6. Collect milling cutter, drill bits and holding devices as per requirements			
7. Use coolant to reduce heat of drill and to prevent material damage and weakening			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Carry Out Grinding of Cutting Tools

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Carry Out Grinding of Cutting Tools
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. Why is it important to carefully inspect grinding wheels?		
2. What is meant by "dressing" grinding wheels?		
3. To what extent is safety a priority in grinding cutting tool work?		
4. What environmental concerns exist in this type of work?		
5. What are profile angles and why are they important?		
6. What are two common types of drill bits?		
7. How important is communication in work of this kind?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Perform Milling Machine Operation

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Perform Milling Machine Operation (SEIP-LIG-MIL-3-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Handle and use milling machine in accord with machine operating manual	☐	☐	☐
2. Identify machine electrical operating switches	☐	☐	☐
3. Select and set R.P.M. in accord with machine R.P.M. selection table/chart and consider milling cutter diameter and work piece material	☐	☐	☐
4. Calculate and apply cutting speed in accord with diameter and R.P.M. of cutter	☐	☐	☐
5. Set feed rate using feed change lever	☐	☐	☐
6. Apply depth of cut according to R.P.M. and feed of machine	☐	☐	☐
7. Identify and select milling cutters according to their holding features	☐	☐	☐
8. Identify milling accessories and attachment	☐	☐	☐
9. Set milling accessories and attachment appropriate to requirements of operation	☐	☐	☐
10. Determine milling methods according to feeding direction and cutter rotations	☐	☐	☐
11. Select milling method according to requirements of job specifications	☐	☐	☐

Observation Checklist: Perform Milling Machine Operation

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Unit of Competency:	Perform Milling Machine Operation
Code:	SEIP-LIG-MIL-3-0
Name of Workplace/Training Center	
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided

During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):

	YES	NO
1. Handle and use milling machine in accord with machine operating manual		
2. Identify machine electrical operating switches		
3. Select and set R.P.M. in accord with machine R.P.M. selection table/chart and consider milling cutter diameter and work piece material		
4. Calculate and apply cutting speed in accord with diameter and R.P.M. of cutter		
5. Set feed rate using feed change lever		
6. Apply depth of cut according to R.P.M. and feed of machine		
7. Identify and select milling cutters according to their holding features		
8. Identify milling accessories and attachment		
9. Set milling accessories and attachment appropriate to requirements of operation		
10. Determine milling methods according to feeding direction and cutter rotations		
11. Select milling method according to requirements of job specifications		

Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**
Feedback to Candidate:		
Candidate's Signature:		Date:
Assessor's Signature:		Date:

Oral Questions Checklist: Perform Milling Machine Operation

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Milling Machine Operation
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What is the function of milling arbors and adaptors?		
2. How is cutting speed calculated?		
3. How is depth of cut calculated?		
4. How are milling cutters identified and selected?		
5. What is meant by "preventive maintenance "and give an example of it?		
6. How are milling methods selected?		
7. What are the PPEs that are commonly used in milling operations?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Perform Indexing Operation Using Indexing Head

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Perform Indexing Operation Using Indexing Head (SEIP-LIG-MIL-4-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Identify and demonstrate the use of different parts of the index head	☐	☐	☐
2. Apply different indexing methods	☐	☐	☐
3. Complete calculations using the indexing formula of different methods of indexing	☐	☐	☐
4. Select index head according to job requirements	☐	☐	☐
5. Perform different indexing methods in accord with job requirements/specifications	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Observation Checklist: Perform Indexing Operation Using Indexing Head

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Perform Indexing Operation Using Indexing Head		
Code:	SEIP-LIG-MIL-4-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Clamp work pieces using appropriate work holding devices to avoid damage and accidents			
2. Cut, chip, and file work pieces in accord with drawing specs			
3. Check measurement of work piece in accord with standard working procedure			
4. Perform drilling of holes and reaming following recommended sequence			
5. Cut threads and check thread using thread pitch gauge			
6. Perform off-hand grinding operation in accord with workplace procedures			
7. Perform welding operations			
8. Perform heat-treatment process			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Perform Indexing Operation Using Indexing Head

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Indexing Operation Using Indexing Head
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What are four methods of indexing?		
2. Do all methods of indexing require the same indexing formula?		
3. Does the selection of an index head depend on job requirements?		
4. To what extent is safety an important element of job planning?		
5. Is a spindle an essential part of an index head?		
6. What are the common PPEs used in indexing operations?		
7. How often should tools and equipment be cleaned?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Perform Plain, Side and Face Milling Operation

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Perform Plain, Side and Face Milling Operation (SEIP-LIG-MIL-5-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Set up the horizontal/vertical machine with a vise on the table and a cylindrical plain, side milling/end milling, face milling cutter on the horizontal/vertical arbor	☐	☐	☐
2. Calculate R.P.M. (cutting speed), feed rate and depth of cut as per job requirement	☐	☐	☐
3. Check machine performance in conformance with job requirement	☐	☐	☐
4. Apply coolant to prevent over heating of work piece and cutting tool	☐	☐	☐
5. Perform plain milling operation using cylindrical plain milling cutter and using conventional milling methods to produce flat surface on job in which cutter axis and job axis are parallel	☐	☐	☐
6. Perform side milling operation using side milling/end milling cutter and to produce flat surface, slots, grooves or finishing the edges of the work pieces	☐	☐	☐
7. Carry out face milling operation to produce a flat surface, which is perpendicular to the axis of the rotating face milling cutter	☐	☐	☐
8. Check/measure job in conformance to specification using appropriate techniques, measuring tools and equipment	☐	☐	☐
	☐	☐	☐

Observation Checklist: Perform Plain, Side and Face Milling Operation

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Perform Plain, Side and Face Milling Operation		
Code:	SEIP-LIG-MIL-5-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Set up the horizontal/vertical machine with a vise on the table and a cylindrical plain, side milling/end milling, face milling cutter on the horizontal/vertical arbor			
2. Calculate R.P.M. (cutting speed), feed rate and depth of cut as per job requirement			
3. Check machine performance in conformance with job requirement			
4. Apply coolant to prevent over heating of work piece and cutting tool			
5. Perform plain milling operation using cylindrical plain milling cutter and using conventional milling methods to produce flat surface on job in which cutter axis and job axis are parallel			
6. Perform side milling operation using side milling/end milling cutter and to produce flat surface, slots, grooves or finishing the edges of the work pieces			
7. Carry out face milling operation to produce a flat surface, which is perpendicular to the axis of the rotating face milling cutter			
8. Check/measure job in conformance to specification using appropriate techniques, measuring tools and equipment			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Perform Plain, Side and Face Milling Operation

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Plain, Side and Face Milling Operation
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What is the purpose of a coolant?		
2. A face milling operation is used to produce what kind of end result?		
3. How often should the milling machine be cleaned?		
4. How are milling cutters selected?		
5. What are some safe working practices that are used when working on a milling machine?		
6. How important is it to be able to interpret specifications?		
7. What are some advantages in using cutting fluid?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Perform Slot, Part Off, End and Angular Milling Operation

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Perform Slot, Part Off, End and Angular Milling Operation (SEIP-LIG-MIL-6-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

During the demonstration of skills, did the candidate:	✓ to show if evidence is demonstrated Yes	No	N/A
1. Set up the horizontal/vertical milling machine with a vise on the table and a cylindrical plain, side milling/end milling, face milling cutter on the horizontal/vertical arbor	☐	☐	☐
2. Calculate and apply R.P.M., cutting speed, feed rate and depth of cut as per job requirement	☐	☐	☐
3. Check machine performance to conform with job requirement	☐	☐	☐
4. Apply coolant to prevent over heating of work piece and cutting tool	☐	☐	☐
5. Perform slot milling operation using an end milling cutter and produce slot, key way slot, and T-slot on the job where the cutter axis and job axis are in parallel	☐	☐	☐
6. Perform parting off milling operation using slitting/parting off milling cutter to separate stock/work pieces	☐	☐	☐
7. Perform axial and radial end milling operation on work pieces making either peripheral slot cuts, profile, slot pocket or complex surface contour cut using an end mill cutter	☐	☐	☐
8. Perform angular milling operation to produce all types of angular cuts on surfaces using angular cutters	☐	☐	☐
9. Check/measure job in conformance with specification using appropriate techniques, measuring tools and equipment	☐	☐	☐

Observation Checklist: Perform Slot, Part Off, End and Angular Milling Operation

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Perform Slot, Part Off, End and Angular Milling Operation		
Code:	SEIP-LIG-MIL-6-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Set up the horizontal/vertical milling machine with a vise on the table and a cylindrical plain, side milling/end milling, face milling cutter on the horizontal/vertical arbor			
2. Calculate and apply R.P.M., cutting speed, feed rate and depth of cut as per job requirement			
3. Check machine performance to conform with job requirement			
4. Apply coolant to prevent over heating of work piece and cutting tool			
5. Perform slot milling operation using an end milling cutter and produce slot, key way slot, and T-slot on the job where the cutter axis and job axis are in parallel			
6. Perform parting off milling operation using slitting/parting off milling cutter to separate stock/work pieces			
7. Perform axial and radial end milling operation on work pieces making either peripheral slot cuts, profile, slot pocket or complex surface contour cut using an end mill cutter			
8. Perform angular milling operation to produce all types of angular cuts on surfaces using angular cutters			
9. Check/measure job in conformance with specification using appropriate techniques, measuring tools and equipment			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Perform Slot, Part Off, End and Angular Milling Operation

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Slot, Part Off, End and Angular Milling Operation
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What is the purpose of performing an angular milling operation?		
2. How is R.P.M., cutting speed, feed rate and depth of cut determined?		
3. What are the types of cutters used in slot milling?		
4. What is the procedure followed on a slot milling operation?		
5. What preventive safety measures must be followed in milling operations?		
6. Why is communication important in the workplace?		
7. What are the types of milling cutters used in axial and radial milling operations?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**

Demonstration Checklist: Perform Gear Cutting Operation on Milling Machines

Candidate's name:	
Assessor's name:	
Qualification:	Milling Machine Operation
Project-Based Assessment Title	
Units of competency covered:	Perform Gear Cutting Operation on Milling Machines(SEIP-LIG-MIL-7-0)
Date of assessment:	
Time of assessment:	

Instructions for demonstration	
Please see attached Instruction for Demonstration (Candidate/Assessor)	
Supplies and Materials ▪ Please refer to attached specific instruction	Tools and equipment • Please refer to attached specific instruction

	✓ to show if evidence is demonstrated		
During the demonstration of skills, did the candidate:	Yes	No	N/A
1. Set up the horizontal/vertical machine with index head on the table and set gear cutter on the horizontal/vertical arbor as per requirement	☐	☐	☐
2. Calculate R.P.M., cutting speed, feed rate and depth of cut, as per job requirement	☐	☐	☐
3. Check machine performance in conformance to job requirement	☐	☐	☐
4. Apply coolant to prevent over heating of work piece and cutting tool	☐	☐	☐
5. Perform different gear cutting operations as per job requirement	☐	☐	☐
6. Check/measure work piece in conformance to specification using appropriate techniques, measuring tools and equipment	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Observation Checklist: Perform Gear Cutting Operation on Milling Machines

Candidate's name:			
Assessor's name:			
Date of Assessment:			
Unit of Competency:	Perform Gear Cutting Operation on Milling Machines		
Code:	SEIP-LIG-MIL-7-0		
Name of Workplace/Training Center			
Procedure to Follow:	Observe Candidate's performing the task, and following the spec- if a spec is provided		
During the demonstration of skills, did the Candidate do the following (List steps that reflect critical aspects of competency from performance criteria of Unit of Competency):			
		YES	**NO**
1. Set up the horizontal/vertical machine with index head on the table and set gear cutter on the horizontal/vertical arbor as per requirement			
2. Calculate R.P.M., cutting speed, feed rate and depth of cut, as per job requirement			
3. Check machine performance in conformance to job requirement			
4. Apply coolant to prevent over heating of work piece and cutting tool			
5. Perform different gear cutting operations as per job requirement			
6. Check/measure work piece in conformance to specification using appropriate techniques, measuring tools and equipment			
Candidate's performance was:	**COMPETENT**	**NOT YET COMPETENT**	
Feedback to Candidate:			
Candidate's Signature:			Date:
Assessor's Signature:			Date:

Oral Questions Checklist: Perform Gear Cutting Operation on Milling Machines

Candidate's name:	
Assessor's name:	
Date of Assessment:	
Assessment Venue:	
Unit of Competency:	Perform Gear Cutting Operation on Milling Machines
Reference Standard:	**Milling Machine Operation**

The List of Questions below must be pegged to the competency demonstration test and may involve related specs for each Unit of Competency tested. Underpinning skills for Knowledge may also be reviewed for Competent/Not Yet Competent designation.

List of Questions	Satisfactory Response

Indicate Y or N in the box provided	YES	NO
1. What is meant by the term "gear teeth nomenclature?"		
2. Can you identify four different types of gear?		
3. Why is safety important when performing gear cutting operations?		
4. Can you name three types of milling machines?		
5. How often should coolant be applied in gear cutting operations?		
6. What are some common materials used in gear cutting operations?		
7. What are two common pressure angles?		
8. Can you name at least three measuring tools?		

Feedback to Candidate:

The Candidate's overall performance was (circle): Satisfactory/ Not Satisfactory

The Candidate's underpinning knowledge was (circle): Satisfactory/ Not Satisfactory

Assessor Signature:	**Date:**
Candidate Signature:	**Date:**